National Park Service
U.S. Department of the Interior

Yellowstone National Park
Wyoming, Montana, Idaho

Yellowstone National Park

DRAFT WINTER USE PLAN / ENVIRONMENTAL IMPACT STATEMENT

May 2011

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
YELLOWSTONE NATIONAL PARK
DRAFT WINTER USE PLAN / ENVIRONMENTAL IMPACT STATEMENT

Lead Agency: National Park Service (NPS), U.S. Department of the Interior

This Yellowstone National Park Draft Winter Use Plan / Environmental Impact Statement (plan/EIS) evaluates the impacts of a range of alternatives for managing winter use/access in the interior of Yellowstone National Park (Yellowstone or the park) in a manner that protects and preserves natural and cultural resources and natural processes, provides a variety of visitor use experiences while minimizing conflicts among various users, and promotes visitor and employee safety. Upon conclusion of the plan/EIS and decision-making process, the alternative selected for implementation will become the winter use plan, which will specifically address the issue of oversnow vehicle (OSV) use in the interior of the park for at least the next 20 years. It will also form the basis for a special regulation to manage OSV use in the park, should an alternative be selected that allows OSV use to continue.

This draft plan/EIS evaluates the impacts of the no-action alternative (alternative 1) and six action alternatives (alternatives 2, 3, 4, 5, 6, and 7). Alternative 1 would not permit public OSV use in Yellowstone because the 2009 interim rule expired March 15, 2011, but would allow for approved non-motorized use to continue. Alternative 1 has been identified as the NPS environmentally preferable alternative**.** Alternative 2 would manage OSV use at the same levels as the 2009 interim rule (up to 318 snowmobiles and 78 snowcoaches per day). Alternative 3 would allow for snowmobile and snowcoach use levels to increase to the levels set forth in the 2004 plan (up to 720 snowmobiles and 78 snowcoaches per day). Alternative 4 would allow for commercially guided wheeled vehicles, in addition to OSVs (up to 100 commercially wheeled vehicles, 110 snowmobiles, and 30 snowcoaches per day). Alternative 5 would initially allow for the same level of use as alternative 2 (up to 318 snowmobiles and 78 snowcoaches per day), but would provide for a transition to snowcoaches only if user demand is present to support such a transition or at the discretion of the park Superintendent. Upon complete transition, there would be zero snowmobiles and up to 120 snowcoaches per day. Alternative 6 would provide for use levels that vary each day, with a seasonal limit of up to 32,000 snowmobiles and 4,600 snowcoaches, and a daily limit of up to 540 snowmobiles and 78 snowcoaches. Up to 25 percent of snowmobile permits under alternative 6 would be for unguided or non-commercially guided use. Alternative 7 would also allow for variable use levels throughout the season, with snowmobile use ranging from 110 to 330 snowmobiles per day and snowcoach use ranging from 30 to 80 vehicles per day. The varying use levels would provide for high and low OSV use days, allowing for a variety of motorized and non- motorized visitor experiences throughout the winter season. Alternative 7 is the NPS Preferred Alternative**.** The draft plan/EIS analyzes impacts of these alternatives in detail for wildlife and wildlife habitat, air quality, soundscapes and the acoustic environment, visitor use and experience, visitor accessibility, health and safety, socioeconomic values, and park operations and management.

The review period for this document will end 60 days after publication of the U.S. Environmental Protection Agency Notice of Availability in the Federal Register. During the 60-day comment period, comments will be accepted electronically through the NPS Planning, Environment and Public Comment website and in hard copy delivered by the U.S. Postal Service or other mail delivery service or hand-delivered to the address below. Oral statements and written comments will also be accepted during public meetings on the draft plan/EIS. Comments will not be accepted by fax, email, or in any other way than those specified above. Bulk comments in any format (hard copy or electronic) submitted on behalf of others will not be accepted.

For further information, visit http://parkplanning.nps.gov/yell or contact:

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EXECUTIVE SUMMARY

This Yellowstone National Park Draft Winter Use Plan / Environmental Impact Statement (plan/EIS) analyzes a range of alternatives and actions for the management of winter use at Yellowstone National Park (Yellowstone or the park). The draft plan/EIS assesses the impacts that could result from implementation of any of the six action alternatives, and assesses the impacts that would occur if the park were to take no action at all (“no-action” alternative).

Upon conclusion of the draft plan/EIS and decision-making process, the alternative selected for implementation will become the winter use plan, which will specifically address the issue of oversnow vehicle (OSV) use in the interior of the park for at least the next 20 years. It will also form the basis for a special regulation to manage OSV use in the park should an alternative be selected that allows OSV use to continue.

BACKGROUND

Winter use in Yellowstone National Park, specifically issues related to OSVs, has been the subject of debate for more than 75 years. At least 12 times since 1930, the National Park Service (NPS) and park stakeholders have formally debated what the park should look and be like in winter. Interest in accessing the park in the winter began in the early 1930s and has increased throughout the years. In the 1970s, 1980s, and early 1990s, snowmobile use in the park grew consistently, with the use of snowcoaches following in popularity. Historically, the increase in the use of these vehicles to enter the park, collectively known as OSVs, brought unanticipated problems, specifically air and noise pollution, conflicts with other users, and harassment of wildlife, as documented in past planning efforts. To address these problems, planning for the management of OSV use began with the park’s Master Plan in 1974 that was a general, park-wide, planning document. Since then, a series of planning processes have examined winter use in Yellowstone. A detailed description of these processes can be found on the park’s winter use website at http://www.nps.gov/yell/planyourvisit/winteruse.htm.

Recently, as a result of litigation over the 2007 planning effort, on September 15, 2008, the U.S. District Court for the District of Columbia vacated the 2007 Winter Use Plan and Final Environmental Impact Statement, as well as the associated Record of Decision and rule. Because the court’s ruling left no provision in place for snowmobile or snowcoach use (effectively meaning that OSV use would not be allowed in the park because there was no rule to support it), the NPS issued an Interim Winter Use Plan / Environmental Assessment on November 3, 2008. A proposed rule to support it was published on November 5, 2008.

However, on November 7, 2008, the U.S. District Court for the District of Wyoming issued an order reinstating the 2004 rule, allowing snowmobile and snowcoach use in Yellowstone until a new rule could be completed. For the winter of 2008/2009, the park operated under the 2004 rule which allowed up to 720 snowmobiles and 78 snowcoaches per day. The Wyoming decision was appealed, but the litigation was declared moot by the 10th Circuit Court of Appeals because the NPS had already developed an interim plan and put into effect a replacement rule.

In 2009, the NPS completed a new Interim Winter Use Plan Finding of No Significant Impact and put into effect a new interim rule. The interim plan and rule allowed access for up to 318 snowmobiles and 78 snowcoaches per day into Yellowstone during the 2009/2010 and 2010/2011 winter seasons. It continued to require all snowmobiles and snowcoaches to be commercially guided, and snowmobiles were required to meet best available technology (BAT) requirements.

In addition, the rule provided for motorized OSV travel over Sylvan Pass and Yellowstone's east entrance road as agreed to by the Sylvan Pass Study Group (the NPS, state of Wyoming, Park County, Wyoming, and the City of Cody). The interim plan and rule did not allow snowmobile and snowcoach use after March 2011.

The interim plan and rule were challenged by the State of Wyoming and Park County, Wyoming. On September 17, 2010, the Wyoming court issued a ruling in favor of the NPS on the interim plan and rule which expired on March 15, 2011, following the close of the 2010/2011 winter season.

PURPOSE OF THE PLAN

The purpose of this draft plan/EIS is to establish a management framework that allows the public to experience the unique winter resources and values at Yellowstone National Park. The draft plan/EIS will be used to determine whether motorized winter use in the interior of the park (including wheeled motor vehicles, snowmobiles, and snowcoaches) is appropriate, and if so, the type, extent, and location of this use.

NEED FOR ACTION

The NPS provides opportunities for people to experience the park in the winter; however access to most of the park in the winter is limited by distance and the harsh winter environment, which presents challenges to safety and park operations. The park offers unique winter experiences that are distinct from other times of the year. In the past, the park has provided access to OSV users; however, the legal authority for OSV use (snowmobiles and snowcoaches) at Yellowstone expired March 15, 2011. Therefore the park is developing this plan because a decision is needed about whether OSV use should continue, and if so, how to direct use to protect resources and values, and how to provide for visitor use and enjoyment.

OBJECTIVES IN TAKING ACTION

Objectives are what must be achieved to a large degree for the action to be considered a success under Director's Order 12 (NPS 2001). All alternatives selected for detailed analysis in this draft plan/EIS meet the objectives to a large degree and resolve the purpose of and need for action. Objectives for managing winter use at Yellowstone are grounded in the park's enabling legislation, purpose, significance, and the goals of the park as stated in planning documents. Objectives are also compatible with direction and guidance provided by the park's strategic plan, 1995 Natural Resources Management Plan, 1974 Master Plan, and other management guidance. The objectives for managing winter use at Yellowstone are stated below.

VISITOR USE

- Provide the opportunity for visitors to experience and be inspired by Yellowstone's unique winter resources and values while ensuring resource protection.
- Increase visitor understanding and appreciation of the park's winter resources.
- Provide access for winter opportunities in the park that are appropriate and universally accessible.

RESOURCES

- Wildlife: Manage winter use so that it does not disrupt the winter wildlife ecology, including sensitive species.
- Sound: Manage winter use to protect naturally occurring background sound levels and to minimize loud noises.
- Air Quality: Manage winter use to minimize impacts to resources that may be affected by air pollution including visibility and aquatic systems.
- Wilderness: Manage winter use to protect wilderness character and values.
- Develop and implement an adaptive management program that includes monitoring the condition of resources.

HEALTH AND SAFETY

- Manage access in the winter for the safety of all visitors and employees, including limiting impacts from emissions, noise, and known hazards.

COORDINATION AND COOPERATION

- Improve coordination and communication regarding winter use management with park partners, gateway communities, and other stakeholders.

PARK MANAGEMENT/OPERATIONS

- Promote advances of vehicle technology (OSVs and commercial wheeled vehicles) that will reduce impacts and facilitate continuous improvement of technology over time.
- Provide for winter use that is consistent with the park priority to provide critical visitor services at core locations.

PURPOSE AND SIGNIFICANCE OF YELLOWSTONE NATIONAL PARK

National park system units are established by Congress to fulfill specified purposes. A park's purpose provides the foundation for decision-making as it relates to the conservation of park resources and providing for the "enjoyment of future generations."

Congress established Yellowstone National Park to "dedicate and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people; … for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition" (U.S. Congress 1872).The park's purpose and significance are rooted in its enabling legislation (as described further under "Related Laws, Policies, Plans, and Constraints"), subsequent legislation, and current knowledge of its natural, cultural, and visual resources. Statements of a park's significance describe why the park is important within a global, national, regional, and ecosystem-wide context and are directly linked to the purpose of the park. Yellowstone is significant for the following reasons:

- It is the world's first national park.
- It preserves geologic wonders, including the world's most extraordinary collection of geysers, hot springs, and the underlying volcanic activity that sustains them. Yellowstone National Park is positioned on a "hot spot" where the earth's crust is unusually thin and molten magma rises relatively close to the surface.
- It preserves abundant and diverse wildlife in one of the largest remaining intact and wild ecosystems on earth, supporting surrounding ecosystems and serving as a benchmark for understanding nature.
- It preserves an 11,000-year continuum of human history, including sites, structures, and events that reflect our shared heritage. This history includes the birthplace of the national park idea—a milestone in conservation history.
- It provides for the benefit, enjoyment, education, and inspiration of this and future generations. Visitors have a range of opportunities to experience the essence of Yellowstone National Park's wonders and wildness in a way that honors the park's value to the human spirit and deepens the public's understanding and connection to it.

ISSUES AND IMPACT TOPICS

Issues associated with implementing a winter use management plan at Yellowstone were initially identified by the Yellowstone Winter Use project team during internal scoping and were further refined through public scoping and consultation with cooperating agencies. Table ES-1 details the issues that were discussed and analyzed in the draft plan/EIS.

TABLE ES-1. ISSUES AND IMPACT TOPICS

Issue	Reason for Analysis
Wildlife and Wildlife Habitat, including Rare, Unique, Threatened, or Endangered Species, and Species of Concern	Various elements of the alternatives evaluated (including the use of snowmobiles, snowcoaches, OSV road grooming, and wheeled vehicles and plowed roads) on wildlife in the interior of the park, have the potential to impact the park's wildlife. Specifically, the species below were selected for detailed analysis in this draft plan/EIS, due to the potential impacts of winter use. Elk and bison have also been the subject of numerous studies relating to OSV use and they are potentially subject to encounters and conflicts with OSV users and other winter visitors, and are brought up as species of concern by the public during scoping. These two ungulates are therefore retained for analysis in this draft plan/EIS. Three species, Canada lynx (*Lynx canadensis*), grizzly bear (*Ursus arctos horribilis*), and gray wolf (*Canis lupus*), are listed or treated (they are species of special concern in the park) as threatened under the Endangered Species Act and could be impacted by OSV use and associated actions. However, grizzly bears are unlikely to experience more than minor adverse effects from OSV use, and were therefore not further evaluated in this draft plan/EIS. Canada lynx and gray wolf; however, have been carried forward for analysis because they could be impacted by OSV use and associated actions. Additional species of concern that could be adversely affected by OSV use and its associated actions and are relatively rare in the park or in need of special protection include the wolverine (*Gulo gulo*), bald eagle (*Haliaeetus leucocephalus*), and trumpeter swan (*Cygnus buccinator*). These species could be impacted by OSV use including noise and human presence and have been the subject of several studies related to OSV use.

Issue	Reason for Analysis
Air Quality	Air quality is a key resource in itself as well as a highly prized (and expected) element of the park visitor experience. Potential impacts to air quality from winter use in Yellowstone National Park include air-quality related issues from exhaust as well as visibility (particularly from OSV emissions). During public scoping for this planning effort, as well as past planning efforts, public and cooperating agency comments raised concern about exhaust emissions from the various forms of OSV travel, as well as suggestions for how air quality should be analyzed in the draft plan/EIS (consideration of new technologies, development of an air monitoring protocol, among others). Because of the potential impacts of snowmobile, snowcoach, and/or bus travel on air quality, including emissions, visibility, and air-quality related values, impacts to air quality are assessed in this draft plan/EIS.
Soundscapes and the Acoustic Environment	Section 4.9 of the NPS *Management Policies 2006* (NPS 2006a) states that the NPS will preserve, to the greatest extent possible, the natural soundscapes of the park, both biological and physical. Natural sounds are intrinsic elements of the environment that are vital to the functioning of ecosystems and can be used to determine the diversity and interactions of species within communities. Soundscapes are often associated with parks and are considered important components of the visitor experience as well as the natural wildlife interactions. Winter soundscapes in Yellowstone consist of both natural and non-natural sounds. During public scoping for this planning effort and during past planning efforts, public and cooperating agency commenters raised concern about the noise levels of various forms of OSV travel. Because of the potential impacts of snowmobile, snowcoach, and bus travel on the park's natural soundscape, impacts to soundscapes and the acoustic environment are assessed in this draft plan/EIS.
Visitor use and Experience	The vast majority of winter visitors use OSVs to access the interior of the park. For some, these vehicles are an integral component of their experience. Others perceive negative impacts from OSV use, even if they used OSVs to access the park. Public input from this and past planning efforts has shown that expectations for a winter visitor experience in the interior of Yellowstone vary among visitors. At issue is the nature of visitor enjoyment and its relationship to the management and conservation of park resources and values. Because of the potential for the impacts of snowmobile, snowcoach, and bus travel on park visitor use and experience, impacts to soundscapes and the acoustic environment are assessed in this draft plan/EIS.
Visitor Accessibility	It is NPS policy to ensure that all people, including those with disabilities, have the highest reasonable level of accessibility to NPS programs, facilities and services. The draft plan/EIS considers and analyzes the potential impacts resulting from changes to accessibility to the interior of the park for the very young, the elderly, and those that are mobility impaired. For these individuals, mobility issues were not considered to be of primary concern; rather, opportunities to access and experience the park, view wildlife and scenery, exposure to winter weather including cold temperatures and high winds, and the need for protection from these elements were considered
Health and Safety	During public scoping for this planning effort, as well as past planning efforts, public and cooperating agency comments indicated concerns for safety regarding the operation of Sylvan Pass, as well as noted potential safety benefits with road plowing in the interior of the park. Health and safety issues associated with some of the actions under consideration in this draft plan/EIS include • The effect of motorized vehicular emissions and noise on employees and visitors • Avalanche hazards • Safety problems where different modes of winter transport are used in the same place or in close proximity. Because of these potential impacts to health and safety, this topic is analyzed in detail in this draft plan/EIS.

Issue	Reason for Analysis
Socioeconomic Values	During this and past planning efforts, public and cooperating agency commenters indicated concern about the potential economic impacts of changing the management of winter use in the park on local businesses. The gateway communities of the park are dependent, in part, on winter use of the park, and any change in management during the winter use period could impact revenue for local businesses. Concerns have also been voiced over affordable access, diversification of gateway community economies, protection of local business opportunities, and a need for additional socioeconomic surveys. Because of the potential impacts on socioeconomics, this topic is analyzed in detail in this draft plan/EIS.
Park Management and Operations	Any changes in winter use in the park could change the level of park staff and time and other resources required and could increase the commitment of limited NPS resources (staff, money, time, and equipment). During public scoping for this planning effort, as well as past planning efforts, public and cooperating agency comments raised concern about the amount of staff and resources needed to carry out each alternative. Because of the potential impacts to park operations from the alternatives under consideration in this draft plan/EIS, this topic is analyzed in detail.

ALTERNATIVES

The National Environmental Policy Act requires federal agencies to explore a range of reasonable alternatives that address the purpose of and need for the action. Alternatives under consideration must include a "no-action" alternative in accordance with 40 CFR 1502.14. Action alternatives may originate from the agency proposing the action, local government officials, or members of the public at public meetings or during the early stages of project development. Alternatives may also be developed in response to comments from coordinating or cooperating agencies.

Alternatives analyzed in this document were developed based on the results of internal and public scoping, and information from the Yellowstone Science Advisory Team, resource workshops, and cooperating agencies, as well as past planning efforts. These alternatives meet the management objectives of the park, while also meeting the overall purpose of and need for the proposed action. Dismissed from further analysis were alternative elements that were considered but were not technically or economically feasible, did not meet the purpose of and need for the project, created unnecessary or excessive adverse impacts to resources, and/or conflicted with the overall management of the park or its resources.

The elements of all seven alternatives are detailed in tables ES-2 and ES-3. How each of these alternatives meets the objectives of the draft plan/EIS is detailed in table ES-4.

ELEMENTS COMMON TO ALL ALTERNATIVES

The following sections describe elements of the alternatives that are common to all alternatives, including the no-action alternative.

Administrative Use

Non-recreational, administrative use of snowmobiles would be allowed by park personnel or parties duly permitted under the provisions of 36 CFR 1.6, or other applicable permit authority. Permitted parties must use snowmobiles that meet BAT requirements unless specifically authorized otherwise by the park superintendent. Such use would not be subject to commercial guide requirements.

Accessibility

All alternatives would continue implementation of transition and action plans for accessibility. All would support the philosophy of universal access in the park. The NPS would continue to make reasonable efforts to ensure accessibility to buildings, facilities, programs, and services.

Plowed Roads

At a minimum, under all alternatives the following roads would continue to be plowed for travel by private wheeled vehicles:

- North entrance to Mammoth Hot Springs
- Mammoth Hot Springs to Upper Terrace Drive
- Mammoth Hot Springs to Tower Junction and the northeast entrance
- Roads within the developed areas at Mammoth Hot Springs, Tower Ranger Station, Lamar Ranger Station, northeast entrance, and Gardiner.

Non-motorized Access

Non-motorized uses include cross-country skiing, backcountry skiing, hiking, and snowshoeing. Where feasible, the park would continue to set tracks for skiing on snow road edges. Backcountry non-motorized use would continue to be allowed in most of the park (see the exception for sensitive areas in the "Management Actions Common to all Winter Use" section below), subject to Yellowstone's Winter Severity Index program.

Emergency Actions

None of the alternatives preclude closures for safety or resource protection. The Superintendent would continue to have the authority to take emergency action to protect park resources or values.

Research Program

The NPS would continue to monitor park resources; however, this may not be at the same levels or with the same research designs that have occurred in past years. This would give the NPS the information necessary to assess impacts of any alternative on park resources and values, and visitor access, and to make adjustments, as appropriate, in winter use management.

Education and Outreach

Under all alternatives, the park would continue to direct education efforts to visitors in wheeled vehicles along the northern road to Cooke City. The visitor center in Mammoth Hot Springs would remain open to the public during the winter.

NO-ACTION ALTERNATIVE

The Council on Environmental Quality requires that the alternatives analysis in an EIS "include the alternative of no action" (40 CFR 1502.14(d)). The no-action alternative is developed for two reasons. First, a no-action alternative may represent the agency's past and current actions or inaction on an issue continued into the future, which may represent a viable alternative for meeting the agency's purpose and need. If this alternative were implemented, Yellowstone would be operated like other national parks in northern latitudes (e.g., Glacier, Mt. Rainier, Lassen Volcanic, for example) that have limited wheeled vehicle access during the winter. Second, a no-action alternative may serve to set a baseline of existing impacts against which to compare the impacts of the action alternatives.

Under alternative 1, the 2009 interim rule (up to 318 snowmobiles and 78 snowcoaches) expired after the 2010/2011 winter season. Future public OSV use in the winter would not be permitted. Non-motorized access and wheeled vehicle use along the northern road would still be allowed.

Under the no-action alternative, the only motorized visitor access would be via wheeled vehicles from Yellowstone’s north to northeast entrances. Yellowstone would be accessible for skiing and snowshoeing and the backcountry would remain open. Because there would be no motorized use in the park’s interior, the winter season would begin once enough snow accumulates to allow for skiing and snowshoeing. The east entrance road would be managed as backcountry; no administrative OSV travel would be allowed and avalanche control operations would not occur along Sylvan Pass during the winter season. The park could be closed for wildlife management; for example during particularly harsh winters, certain portions of the park could be closed to skiing and snowshoeing to minimize impacts on wildlife.

ACTION ALTERNATIVES

Elements that are common to all action alternatives include the following:

- **Best Available Technology**. At a minimum, the BAT requirements now in place would continue to be implemented. Individual alternatives may include additional BAT requirements, as noted below. BAT guidelines would also be developed and implemented for snowcoaches by the 2014/2015 season. Snowcoach BAT requirements would require vehicles that meet Model Year 2010 (or newer) U.S. Environmental Protection Agency (EPA) emission standards as of winter 2014/2015. They would also require that by winter 2014/2015, vehicle sound not to exceed 73 dBA when operating at or near full speed. As part of efforts to limit sound and pollution from OSVs, idling would be limited to no more than 5 minutes at any one time.
- **Personal Protective Equipment**. Personal protective equipment is recommended for snowmobilers, including helmet, snowmobile suit and gloves, proper footwear, and hearing protection. Persons traveling by snowcoach should also wear or have access to appropriate personal protective equipment including winter clothing, footwear, and hearing protection. Non-motorized users are recommended to wear and carry personal protective equipment as appropriate for their winter travel. For all user groups, personal protective equipment should include avalanche rescue gear (shovel, probe, and transceiver), as appropriate.
- **Licensing and Registration**. OSV drivers would be required to possess and carry at all times a valid motor vehicle operator’s license. A learner’s permit would not satisfy this requirement. The license must be carried by the driver at all times. Snowmobiles would be required to be properly registered and display a valid registration from a state or province in the United States or Canada, respectively.
- **Speed Limits**. Maximum speed for all OSV would be 45 miles per hour (mph). Speed limits could be lower in more congested areas or wildlife sensitive corridors. For example, between West Yellowstone and Old Faithful the speed limit would be 35 mph. In developed areas, the speed limit would be 15 to 25 mph.
- **OSV Routes**. OSV use would continue to be allowed only on designated routes, which are groomed roads that normally carry wheeled vehicles in the summer. No off-road or off-route OSV use would be permitted.

- **Cave Falls Road**. Up to 50 snowmobiles per day would be allowed on the snowmobile route to Cave Falls. These snowmobiles would not be required to meet BAT requirements. The 50 snowmobile per day limit for the Cave Falls route would not be part of the snowmobile limits discussed below under the action alternatives.
- **OSV Management**. Early and late entries for special tours would not be permitted, including departures from Snow Lodge. Limited exceptions would be allowed for administrative travel and emergencies.
- **Non-motorized Use Areas**. Approximately 35 miles of park road would continue to be groomed for cross-country skiing. These roads are mainly used during the summer, and are closed to OSV use. The roads may be machine groomed for skiing.
- **Sylvan Pass Avalanche Control**. For action alternatives that include maintaining Sylvan Pass for OSV access (all alternatives, excluding alternative 4), a combination of avalanche mitigation techniques may be used, including forecasting and helicopter and howitzer dispensed explosives. The results of the most recent safety evaluation of Sylvan Pass by the Occupational Safety and Health Administration and an Operational Risk Management Assessment would be reviewed and the NPS would evaluate additional avalanche mitigation techniques and risk assessment tools to further improve safety and visitor access.
- **Adaptive Management**. All action alternatives incorporate adaptive management initiatives that are designed to assist the park in meeting the objectives of this draft plan/EIS. See appendix A for more details on adaptive management.
- **Education and Outreach.** All action alternatives would include the continuation of educational efforts in the interior of the park including programs at the warming huts and Snow Lodge, among others.

The action alternatives, alternatives 2-7, are as follows:

Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits. Under alternative 2, management of OSVs would allow for snowmobile and snowcoach use levels to continue at the current level of up to 318 snowmobiles and 78 snowcoaches per day. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation restrictions, and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches.

Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits. Alternative 3 would allow for snowmobile and snowcoach use levels to increase to the levels set forth in the 2004 plan of up to 720 snowmobiles and 78 snowcoaches per day. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation restrictions, and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches.

Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles. Alternative 4 would provide a wide range of visitor use and opportunities, managing for commercial wheeled-vehicle use (no private vehicles would be allowed), OSV use, and non-motorized use throughout the park during the winter use season. The roads from West Yellowstone and Mammoth Hot Springs to Old Faithful would be plowed for access to the park by up to 100 wheeled commercial multi-passenger vehicles (buses and vans) per day. The south entrance would be groomed for use of up to 110 snowmobiles and 30 snowcoaches per day. East entrance (Sylvan Pass) would be closed to use during the winter season. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation restrictions, and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches.

Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only. Under alternative 5, OSV access to the park would be via BAT snowcoach only. This could be accomplished by phasing out snowmobiles beginning in the 2014/2015 season when all snowcoaches must meet BAT requirements. Snowcoaches could replace snowmobiles within a five-year period (depending on coach user demand or at the discretion of the park). Should snowcoach user demand not reach 120 snowcoaches, some level of snowmobile use would remain. Alternative 5 would initially provide for both snowmobile and snowcoach access under 2009 interim rule use levels of up to 318 snowmobiles and 78 snowcoaches per day. After the 2014/2015 season, snowcoach numbers could increase up to 120 per day, with a corresponding decrease in snowmobile numbers during the phase-out period. In the event that snowmobile technology improves in the future, this alternative would allow an operator to replace BAT coaches with electric, hybrid, or low emission snowmobiles as long as the combined CO+HC+ NO_x emissions do not exceed 50 grams per mile (or the equivalent grams per kilowatt-hour) and the sound level is less than 70 dbA, when measured by current J192 test procedures.

Alternative 6: Implement Variable Management. Alternative 6 would manage OSV and visitor use to increase the variety of winter experiences by creating times and places for higher and lower levels of use and opportunities for undisturbed skiing and snowshoeing. OSV use would have a seasonal limit of up to 32,000 snowmobiles and 4,600 snowcoaches, with a daily limit of up to 540 snowmobiles and 78 snowcoaches. Up to 25 percent of snowmobile permits would be for unguided or non-commercially guided use. Most of the OSV requirements under the 2009 interim rule would continue including hours of operation restrictions and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches. In addition, operators would have the potential to increase their daily limits if they include and use newer, and cleaner, technologies in their fleets.

Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors. Alternative 7 proposes a variety of use levels, which would establish a maximum number of snowmobiles and snowcoaches permitted in the park for specific days throughout the winter season. Four different use levels for each OSV type would be implemented; the combination of which may vary by day. Snowmobile use would range from 110 to 330 per day and snowcoach use would range from 30 to 80 per day. The varying use levels would provide for high and low OSV use days, and allow for a variety of motorized and non-motorized visitor experiences throughout the winter season. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation, and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches, as well as additional BAT for snowmobiles that address NO_x and require snowcoaches not to exceed 73 dBA when operating at or near full speed for the 2014/2015 winter season. All OSV would be required to enter the park by 10:30 a.m. In addition, OSV concessioners could have the potential to increase their daily limits if they include newer, cleaner technologies in their fleets.

ENVIRONMENTAL CONSEQUENCES

Impacts of the alternatives were assessed in accordance with Director's Order 12 and Handbook: Conservation Planning, Environmental Impact Analysis and Decision-Making. This handbook requires that impacts on park resources be analyzed in terms of their context, duration, and intensity. The analysis provides the public and decision-makers with an understanding of the implications of winter management actions in the short and long term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists.

For each impact topic, methods were identified to measure the change in the park's resources that would occur with the implementation of each management alternative. Intensity definitions were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial.

Each management alternative was compared to baseline conditions (alternative 1, no OSV use) to determine the context, duration, and intensity of resource impacts.

Table ES-5 summarizes the results of the impact analysis for the impact topics that were assessed.

TABLE ES-3. SUMMARY OF ALTERNATIVE ELEMENTS

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
General Description	Once the 2009 interim rule expired (after the 2010/2011 season) there would be no rule in place and OSV use would be no longer permitted. Administrative OSV use would continue as needed. Visitors could ski or snowshoe into the park.	OSV use would continue at levels described under the 2009 interim rule – up to 318 snowmobiles and up to 78 snowcoaches per day.	OSV levels in the park would return to the 2004 plan limits – up to 720 snowmobiles and 78 snowcoaches a day.	Access to the park would be by commercial wheeled vehicles (north and west entrances) and snowmobiles and snowcoach (south entrance) only. No private vehicles would be permitted. The east entrance would be closed to through travel for OSVs, but open for non-motorized use.	OSV access into the park could transition towards snowcoaches meeting BAT requirements. Snowcoaches could replace snowmobiles beginning in the 2014/2015 winter season, when all snowcoaches must meet BAT requirements. Snowcoaches could replace snowmobiles within a five-year period, depending on snowcoach use demand.	Management of winter use would be structured to increase the variety of winter experiences. OSV levels would vary by creating times and places for higher and lower levels of use. Additional opportunities for undisturbed skiing and snowshoeing would also be created.	Various use levels would establish a maximum number of snowmobiles and snowcoaches permitted in the park for specific days throughout the winter season. Four different use levels for each OSV type would be implemented; the combination of which may vary by day. Snowmobile use would range from 110 to 330 per day and snowcoach use would range from 30 to 80 per day.
Elements Related to Snowmobile Use							
Daily Snowmobile Limits (with allocations by entrance)	n/a	Up to 318 snowmobiles per day (Actual current average is about 187 per day). Entrance allocations: • West – 160 • South – 114 • East – 20 • North – 12 • Old Faithful – 12	Up to 720 snowmobiles per day. Entrance allocations: • West – 414 • South – 246 • East – 20 • North – 20 • Old Faithful – 20	Up to 110 snowmobiles per day. Entrance allocations: • South – 66 • Old Faithful – 22 • Norris – 22	Up to 318 snowmobiles per day through 2014/2015 winter season. Initial entrance allocations are the same as alternative 2. Gradual reduction to zero snowmobiles would occur after the 2014/2015 season, as BAT snowcoach numbers increase (see “Elements Related to Snowcoaches,” below). As parkwide snowmobile numbers are reduced, entrance allocations would be reduced proportionally.	32,000 snowmobiles would be permitted each season. Daily numbers could vary between 0 and 540.	Up to 330 snowmobiles per day maximum for one-half of the winter season (45 days) Entrance allocations: • West: 176 • South: 110 • East: 22 • North: 11 • Old Faithful: 11 Up to 220 per day maximum for one-third of winter season (30 days) Entrance allocations: • West: 110 • South: 66 • East: 0 to 22 (East closed Dec. 15–21 and March 2–15) • North: 11 (1 group) • Old Faithful: 11 (1 group) Between 110 and 143 per day maximum for one-sixth of winter season (16 days) Entrance allocations: • West: 66 • South: 44 • East: 0–11 (East closed Dec. 15–21 and March 2-15) • North: 0 – 11 (North closed early for spring plowing) • Old Faithful: 0 – 11
Variable snowmobile numbers	n/a	Daily snowmobile levels would be fixed for the season. No variation would occur.	Daily snowmobile levels would be fixed for the season, with no variation.	Daily snowmobile levels would be fixed for the season, with no variation.	Daily snowmobile levels would be fixed for the season, with no variation.	Snowmobile levels would vary (daily, weekly or monthly) based on a pre-determined seasonal schedule.	Snowmobile levels would vary (daily, weekly, or monthly) based on a pre-determined seasonal schedule. The schedule would provide low and high use opportunities during holiday and non-holiday periods.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Variable entrance allocations	n/a	Entrance allocations would be fixed (may not be shared between entrances).	Entrance allocations would be fixed (no sharing between entrances).	Entrance allocation could be flexible, based on the demand at the three snowmobile entrance locations (sharing allowable among South, Norris, and Old Faithful).	Allocation of snowmobiles by entrance could be flexible, based on demand (i.e., sharing among West, South, East, North, and Old Faithful).	Daily entrance allocation for commercially guided groups could be flexible, to provide and accommodate a variety of winter experiences. For example, daily allocations not used at one gate could be used at another gate that same day.	Allocation of snowmobiles by entrance could be flexible, based on demand (i.e., sharing among West, South, East, North, and Old Faithful).
Snowmobile Guide Requirements, including maximum group size (if applicable)	n/a	100 percent commercially guided. Group size (including guide):11	100 percent commercially guided. Group size (including guide):11	100 percent commercially guided. Group size (including guide):11	100 percent commercially guided. Group size (including guide):11	Mostly guided, with up to 25 percent of snowmobile use unguided or non-commercially guided. Group size (including guides): Maximum group sizes may vary between 11 and 22 snowmobiles. Groups up to 11 would have one guide, between 12 and 22 would have two guides.	100 percent commercially guided. Group size (including guide):11
BAT Requirements for Snowmobiles	n/a	BAT required for snowmobiles.	BAT required for snowmobiles.	BAT required for snowmobiles.	BAT required for snowmobiles.	BAT required for snowmobiles. As this technology improves (hybrid, electric, etc.), consider additional permits for those companies that use them.	Develop additional BAT standard for NO_x, to be implemented by 2014/2015 winter. Proposal: Sum of NO_x and HC not to exceed 15 g/kW-hr. Adopt updated SAE sound testing methodology by 2014/2015 (the barometric pressure variance would no longer apply). As technology improves (hybrid, electric, etc.), consider additional permits for those companies that use them.
Fee for snowmobile use	n/a	Yes	Yes	Yes	Yes	Current fees for snowmobile use and commercial operators would continue. A comparable special use fee may be charged for non-guided/non-commercially guided snowmobile use to manage that use.	Yes

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Elements Related to Snowcoach Use							
Daily Snowcoach Limits (with allocations by entrance)	n/a	Up to 78 snowcoaches per day. Entrance allocations: • West – 34 • South – 13 • North – 13 • East – 2 • Old Faithful – 16	Up to 78 snowcoaches per day through 2014. Entrance allocations: • West – 34 • South – 13 • North – 13 • East – 2 • Old Faithful – 16	Up to 30 snowcoaches per day. Entrance allocations: • South – 20 • Old Faithful – 8 • Norris – 2	Up to 78 snowcoaches per day initially, allocated by entrance the same as in alternative 2. As of 2014/1015, increase to up to 120 BAT snowcoaches per day (with a corresponding decrease in snowmobiles over a five-year period as snowcoach numbers increase). As the number of snowcoaches throughout the park increases, their allocation by entrance would rise proportionally.	4,600 snowcoaches would be permitted per season. Daily use limits would vary between 0 and 78.	Up to 80 snowcoaches per day maximum for one-half of winter season (45 days) Entrance allocations: • West: 36 • South: 14 • East: 2 • North: 12 • Old Faithful: 16 Up to 50 snowcoaches per day maximum for one-third of winter season (30 days) Entrance allocations: • West: 22 • South: 8 • East: 0 to 2 (East closed Dec. 15–21 and March 2–15) • North: 8 • Old Faithful: 10 Between 30 and 80 snowcoaches per day maximum for one-sixth of winter season (16 days) under one of two entrance allocations Allocation 1: • West: 12 • South: 6 • East: 0 (East closed Dec. 15–21 and March 2–15) • North: 6 (North closed early for spring plowing) • Old Faithful: 6 Allocation 2: • West: 36 • South: 14 • East: 2 • North: 12 • Old Faithful: 16
Variable snowcoach numbers	n/a	Daily snowcoach levels would be fixed for the season. No variation would occur.	Daily snowcoach levels would be fixed for the season. No variation would occur.	Daily snowcoach levels would be fixed for the season. No variation would occur.	Daily snowcoach levels would be fixed for the season. No variation would occur.	Snowcoach levels would vary (daily, weekly or monthly) based on a pre-determined seasonal schedule.	Snowcoach levels would vary (daily, weekly or monthly) based on a pre-determined seasonal schedule.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Variable entrance allocations	n/a	Entrance allocations would be fixed (may not be shared between entrances).	Entrance allocations would be fixed (may not be shared between entrances).	Entrance allocation would be flexible, based on the demand at the three snowcoach entry locations (i.e., sharing among South, Norris, and Old Faithful).	Entrance allocation would be flexible, based on the demand at the three snowcoach entry locations (i.e., sharing among West, South, East, North, and Old Faithful).	Daily entrance allocation for snowcoaches would be flexible, to provide and accommodate a variety of winter experiences. For example, daily allocations not used at one gate could be used at another gate that same day.	Daily entrance allocation for snowcoaches would be flexible, to provide and accommodate a variety of winter experiences. For example, daily allocations not used at one gate could be used at another gate that same day.
Snowcoach Guide Requirements	n/a	Common to all action alternatives: snowcoach entry by commercial guide only.					
Snowcoach BAT requirements	n/a	Common to all action alternatives: BAT would be developed and implemented for snowcoaches by the 2014/2015 season. Draft proposal: Require vehicles meet Model Year 2010 EPA emission standards. Not to exceed 73 dBA when operating at or near full speed.					
Wheeled Vehicle Access							
	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road from Mammoth Hot Springs to Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. In addition, the north (Mammoth) and west (West Yellowstone) entrance roads would be plowed to Old Faithful to accommodate multi- passenger commercial vehicles (e.g., vans, buses, etc.). No private vehicles would be permitted. Daily limit of up to 100 Tier 2 (EPA standard) vehicles.	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the Mammoth to Cooke City Road. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road from Mammoth Hot Springs to Cooke City. No other roads would be plowed for wheeled vehicle use.
Other/General Elements							
Road Grooming	Minimal road grooming needed to maintain administrative access. Sylvan Pass management would not be maintained.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.	Continued road grooming needed to maintain snowcoach and administrative access. Sylvan Pass would be closed to vehicle traffic and not be maintained.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement. Certain side roads would be groomed for non-motorized uses only during certain times/days of the season.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Zoning – Temporal and Spatial	n/a	Continued temporal and spatial zoning of some side roads (e.g., snowcoaches only in the morning, snowmobiles and snowcoaches in the afternoons).	Continued temporal and spatial zoning of some side roads (e.g., snowcoaches only in the morning, snowmobiles and snowcoaches in the afternoons).	Most side roads would become cross-country ski and snowshoe routes.	Most side roads would become cross-country ski and snowshoe routes.	Side roads would become ski and snowshoe routes at certain times of the season. OSV use would end at West Thumb Junction and at the Canyon developed area for the last two weeks of the season to accommodate more non-motorized snow recreation on the east side of the park. OSV permits would be allocated in ways that allow for zoning by space and time to accommodate a variety of visitor uses and to protect park resources.	Side roads would become ski and snowshoe routes throughout the season. These roads would be groomed. OSV use would end at West Thumb Parking Area Junction and at the South Canyon Rim Drive for the last two weeks of the season to accommodate more non-motorized snow recreation on the east side of the park. All OSVs must enter the park by 10:30 a.m.
Opportunities for non-motorized recreation use	Park would be open for skiing and snowshoe access. Most of the park would be considered "backcountry" for this type of use.	Continue to groom 35 miles of secondary park roads for cross-country skiers and snowshoers. Use will be permitted subject to Winter Severity Index.	Continue to groom 35 miles of secondary roads for cross-country skiers and snowshoers. Use will be permitted subject to Winter Severity Index.	Use would be permitted subject to Winter Severity Index. Use on South and East entrance roads could increase during the park's spring "shoulder" season. Continue to groom 35 miles of secondary roads for cross-country skiers and snowshoers. Additional secondary roads (approximately 10 miles) would be groomed for non-motorized use access at stopping points along plowed roads (primarily West to Old Faithful). Backcountry experience on east side of park would be available for non-motorized users.	Non-motorized use would be permitted subject to a Winter Severity Index for temperature and weather. Use along the South and East entrance roads could increase during the park's spring "shoulder" season. Continue to groom 35 miles of secondary roads for cross-country skiers and snowshoers. Additional secondary roads (approximately 10 miles) would be groomed for non-motorized use access at stopping points along plowed roads (primarily from West Yellowstone to Old Faithful).	Allowed subject to Winter Severity Index. Manage non-motorized use in time and space to provide for a variety of visitor uses (see Zoning).	In addition to the roads and areas described above in Zoning – Temporal and Spatial, continue to groom 35 miles of secondary park roads for cross-country skiers and snowshoers. Use would be permitted subject to Winter Severity Index.
Dates/Length of Winter Season	The season would start when accumulation of snow allows for non-motorized use. It would continue into March, depending on snow levels and any closures for wildlife management and spring road plowing).	No change in current dates for motorized and non-motorized winter use in the park.	No change in current dates for motorized and non-motorized winter use in the park.	No change in current dates for motorized and non-motorized winter use in the park.	No change in current dates for motorized and non-motorized winter use in the park.	Opening and closing dates could vary to accommodate a variety of visitor experiences and needs. The schedule would be determined no later than Dec. 1 of the previous year.	No change in current dates for motorized and non-motorized winter use in the park; however, OSV use would not start before snow conditions permit.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Estimated number of daily vehicle passengers (excludes Mammoth to Cooke City)	Zero OSVs or wheeled vehicles	Snowmobile = 413 Snowcoach = 624 Total = 1,037	Snowmobile passengers = 936 Snowcoach passengers = 624 Total = 1,560	Snowmobile passengers = 143 Snowcoach passengers = 240 Wheeled vehicle passengers = 2000 Total = 2,383	Snowmobile passengers = 413 (potentially 0 after phase out) Snowcoach passengers = 624 (potentially 960 after phase out) Total = 1,037 (potentially 960 after phase out)	Snowmobile passengers = 408 Snowcoach passengers = 361 Total = 769	Days with 330 snowmobiles and 80 coaches: • Snowmobile passengers = 429 • Snowcoach passengers = 640 • Total = 1,069 Days with 220 snowmobiles and 50 coaches: • Snowmobile passengers = 286 • Snowcoach passengers = 400 • Total = 686 Days with 110 snowmobiles and 30 coaches: • Snowmobile passengers = 143 • Snowcoach passengers = 240 • Total = 383 Days with 143 snowmobiles and 80 coaches: • Snowmobile passengers = 186 • Snowcoach passengers = 640 • Total = 886
Transition Period	The 2009 interim rule expired. No transition period.	The 2009 interim rule would continue. No transition period.	There would be a one-season transition period to prepare for implementation of the new winter use plan. Provisions of the 2009 interim rule would continue during this transition.		Because the 2009 interim rule provisions are the starting point for alternative 5, there would not be a transition year.	There would be a one-season transition period to prepare for implementation of the new winter use plan. Provisions of the 2009 interim rule would continue during this transition.	
Adaptive Management Program	No adaptive management program would be implemented.	Common to all action alternatives: Adaptive management planning would be standard procedure, but elements and emphases of its use could differ from one alternative to another.					

TABLE ES-4: HOW ALTERNATIVES MEET OBJECTIVES

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Visitor Use							
Provide the opportunity for visitors to experience and be inspired by Yellowstone's unique winter resources and values while ensuring resource protection.	Meets objective to some degree because the interior of the park would be accessible only by non-motorized users and difficult to access by most visitors. Visitors could also continue to experience the park virtually through the park's website.	Meets objective to a large degree, because visitors would be able to experience the interior of the park with wheeled vehicles and OSVs from all entrances. Daily use limits of 318 snowmobiles and 78 snowcoaches would be similar to current use levels, which monitoring has shown allow for resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Meets objective to a moderate degree because visitors would be able to experience the interior of the park with wheeled vehicles and OSVs from all entrances. The increase in visitation over the current condition may lead to challenges in ensuring resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Fully meets objective because visitors would have a wide variety of choice in how to access the interior of the park, with these choices likely being more economical. With the addition of plowed roads, it is likely more visitors would be able to visit the park and see Yellowstone's unique winter resources. Use levels, and mix of use, would be expected to ensure resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Meets objective to a moderate degree because visitors would be provided the opportunity to experience the interior of the park using OSV; however, after the transition period, it is likely that the mode in which one can enter would be limited to snowcoaches. This alternative would reduce overall OSV traffic, below current levels, and would ensure resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Meets objective to a large degree because the variety of winter experiences would increase by creating times and places for higher and lower levels of use and opportunities for undisturbed skiing and snowshoeing. Although there would be the potential for days with higher use than the current condition, there would also be lower use days, and overall this alternative would ensure resource protection. Visitors would be able to experience the interior of the park with OSVs from all entrances. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Fully meets objective because the variety of winter experiences would increase by creating times and places for higher and lower levels of use and opportunities for undisturbed skiing and snowshoeing. Although use would have higher and lower use days, the maximum use days would be at levels that are similar to those currently permitted. With levels of use that those levels or less, this alternative would ensure resource protection. Visitors would be able to experience the interior of the park with OSVs from all entrances. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.
Increase visitor understanding and appreciation of the park's winter resources.	Meets objective to some degree because the interior of the park would be closed to OSV use, greatly limiting the visitors that can experience this area. The park would continue to provide a virtual experience for all, including administration of the website to provide understanding and appreciation of the park's winter resources to those unable to visit the park.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.
Provide access for winter opportunities in the park that are appropriate and universally accessible.	Meets objectives to some degree because transportation to the interior of the park would no longer be available, but non-motorized uses and virtual visitation would continue.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Fully meets objective because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Resources							
Wildlife: Manage winter use so that it does not disrupt the winter wildlife ecology, including sensitive species.	Meets objective to a large degree because wildlife, including sensitive species, in the interior of the park would no longer have interactions with recreational OSV. Interactions with non-motorized users would continue to occur, on a limited basis.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be similar to those currently occurring, which monitoring has shown disrupts wildlife minimally.	Meets objective some degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be greater than those currently occurring, which could result in more disruption to wildlife.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of wheeled vehicles and OSVs. Winter use levels would be similar or less than to those currently occurring, which monitoring has shown disrupts wildlife minimally.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be less than to those currently occurring once the transition to snowcoaches only is complete, which monitoring has shown disrupts wildlife minimally.	Meets objective some degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be greater than those currently occurring, which could result in more disruption to wildlife.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be similar to those currently occurring, which monitoring has shown disrupts wildlife minimally. Lower use days below the levels that are currently occurring would result in less disruption to wildlife.
Sound: Manage winter use to protect naturally occurring background sound levels and to minimize loud noises.	Meets objectives to a large degree because minimal OSV use (administrative use only) would occur in the interior of the park.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.	Meets objective to some degree because OSV use would occur in the interior of the park, at levels that would reduce times of natural quiet compared to current use levels.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.	Meets objectives to some degree because OSV use would occur in the interior of the park, at levels that would reduce times of natural quiet compared to current use levels.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.
Air Quality: Manage winter use to minimize impacts to resources that may be affected by air pollution including visibility and aquatic systems.	Meets objective to a large degree because minimal OSV use (administrative use only) would occur in the interior of the park and air emissions would be at very low levels.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to or less than current use levels, which monitoring has shown to be below all regulatory standards.
Wilderness: Manage winter use to protect wilderness character and values.	Meets objective to a large degree because minimal OSV use (administrative use only) would not occur in the interior of the park.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Health and Safety							
Seek to manage access in the winter for the safety of all visitors and employees, including limiting impacts from emissions, noise, and known hazards.	Meets objective to a large degree because recreational OSV use would not occur in the interior of the park. Emissions, noise, and known hazards would be reduced because the interior of the park would be closed to the public; however, non-motorized use (skiing and snowshoeing) would be permitted in the interior of the park, resulting in known hazards from harsh winter conditions.	Meets objective to some degree **as** OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree **as** OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets the objectives to a large degree because wheeled vehicle, OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. The requirement for all wheeled vehicles to be commercially guided would further promote the health and safety of visitors. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Sylvan Pass would not continue to operate, greatly reducing the risk to park staff that would no longer be exposed to the hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree because OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree because OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree because OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.
Coordination and Cooperation							
Improve coordination and communication regarding winter use management with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.
Park Management/Operations							
Develop and implement an adaptive management program that includes monitoring the condition of resources.	Meets objective to a large degree because the adaptive management program under no action would differ from the action alternatives. It would focus on monitoring park resources in the near absence of OSVs and understanding if changes to limited administrative OSV use and non-motorized uses are needed.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Promote advances of vehicle technology (OSVs and commercial wheeled vehicles) that will reduce impacts and facilitate continuous improvement of technology over time.	Does not meet objective because OSVs would not be allowed into the park, reducing the incentive for the development of new technology.	Meets objective to a moderate degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. No additional steps would be taken to promote technology.	Meets objective to a moderate degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. No additional steps would be taken to promote technology.	Meets objective to a moderate degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. No additional steps would be taken to promote technology.	Meets objective to a large degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. Further incentives for the advancement of snowcoaches would be provided as more snowcoaches would be permitted as BAT becomes available. In addition, as new technologies come on line (electric for example) snowmobile operators would have the potential to replace BAT coaches.	Fully meets objective because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. In addition, as new technologies come on line (electric for example) operators would have the potential to increase their daily limits if they include newer, and cleaner, technologies in their fleets.	Fully meets objective because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. In addition, new BAT requirements for NO_x would also be developed, which would also promote advances in technology and operators could have the potential to increase their daily limits if they include newer, and cleaner, technologies in their fleets.
Provide for winter use that is consistent with the park priority to provide critical visitor services at core locations.	Meets objective to some degree because services in the northern area of the park (Mammoth) would continue to be provided. Due to lack of OSV access, services in the interior of the park would not continue.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV and wheeled vehicle use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.

TABLE ES-5: IMPACT SUMMARY

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Wildlife and Wildlife Habitat, including Rare, Unique, Threatened, or Endangered Species, and Species of Concern							
Bison/Elk	Based on an analysis of the available data and literature regarding bison and elk in the greater Yellowstone area, the no-action alternative would result in short and long-term negligible adverse impacts on bison and elk in the park, because OSV use would be limited to minimal administrative use and non-motorized use would be more limited, resulting in no observable impacts. Human activity during the winter months would be reduced and any beneficial wildlife impacts would likely only be apparent over several decades of minimal OSV traffic in the park. Cumulative impacts under alternative 1 would be long-term minor to major adverse. Alternative 1 would contribute minimally to cumulative impacts because there would be no visitor OSVs in the park.	Alternative 2 would allow for use levels similar to the 2009 interim rule, with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Thus, overall impacts under alternative 2 would be short and long-term minor to moderate adverse. Cumulative impacts would be long-term minor to major adverse, of which alternative 2 would contribute minimally.	Under alternative 3, daily use limits of up to 720 snowmobiles and 78 snowcoaches along with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only would result in short and long-term minor to moderate adverse impacts. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Cumulative impacts on bison and elk under alternative 3 would be long-term minor to major adverse.	Under alternative 4, daily use limits of up to 110 snowmobiles, 100 guided wheeled vehicles, and 30 snowcoaches, along with BAT requirements, guiding regulations, speed limits, plowing design, and restrictions on OSV access to park roads only, would result in short- and long-term, negligible to minor adverse impacts. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Cumulative impacts would be long-term minor to major adverse, of which alternative 4 would be a small part.	The existing data suggest that the higher visual profile of a snowcoach may elicit stronger bison and elk behavioral responses than snowmobiles. Thus, restricting OSVs to just snowcoaches would not eliminate adverse effects on wildlife. However, the available literature on bison and elk indicate that lower OSV numbers and associated recreation reduce vehicle-caused mortality, wildlife displacement, behavior or physiology-related energy costs, and the potential for adverse demographic impacts, resulting in short and long-term minor adverse impacts. Cumulative impacts on bison and elk under alternative 5 would be long-term minor to major adverse, to which alternative 5 would contribute a small amount.	The variable number of OSVs allowed per day under this alternative would likely increase the behavioral responses of bison and elk due to daily unpredictability and reduced potential for habituation. These increased responses are due in part to the larger snowmobile group sizes (22 individual vehicles rather than 11) allowed under this alternative, which have been found to increase the probability of strong behavioral and associated physiological responses, leading to possible displacement of bison and elk and resulting in long-term moderate adverse impacts. Additionally, the unguided/non-commercially guided provision, variable daily OSV numbers, and high use limits may result in decreased habituation and increased behavioral, physiological and displacement responses by bison and elk. Measures under this alternative, including BAT snowmobiles, variable use limits, closing of certain roads to motorized traffic two weeks prior to the end of the season, and setting limits on seasonal numbers of snowmobiles and snowcoaches in the park, would help limit wildlife impacts. Impacts under alternative 6 would be long-term minor to moderate adverse, due to unguided provision, variable limits, and increased group size. Cumulative impacts on bison and elk under alternative 6 would be long-term minor to major adverse, to which alternative 6 would contribute a noticeable amount.	Alternative 7 would allow use levels similar to the 2009 interim rule, with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only. Variable use levels allow for continued monitoring and adaptive management to establish additional restrictions to be established should negative impacts on wildlife begin to occur. Thus, overall impacts under alternative 7 would be short- and long-term minor to moderate adverse. Cumulative impacts would be long-term minor to major adverse, to which alternative 7 would contribute a small amount.

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Lynx/Wolverine	Alternative 1 would result in short- and long-term negligible adverse impacts on lynx and wolverines in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts, with long-term beneficial impacts from the removal of human presence. Cumulative impacts of alternative 1 would be long-term minor to major adverse, of which alternative 1 would contribute minimally.	This alternative would maintain and allow OSV use at Sylvan Pass, the area of the park where human-wolverine interactions would be most likely to occur. However, daily entrance limits restrict the east entrance to just 20 snowmobiles and two snowcoaches per day, (five groups of OSVs), resulting in little use in this area, and minimal disturbance to wolverines. Restrictions on movements of lynx or wolverines during the winter months due to the presence and use of OSV routes in other areas of the park may limit reproductive success, dispersal, and overall genetic sustainability of the species, but such impacts are difficult to predict. Therefore, impacts predicted under this alternative would be long-term minor adverse, with the potential for moderate adverse impacts if lynx and wolverines travel outside the eastern area of the park. Cumulative impacts to lynx and wolverines under alternative 2 would be long-term minor to major adverse, of which alternative 2 would contribute a minimal amount.	This alternative continues to maintain and allow OSV use in Sylvan Pass, the area of the park where human-wolverine interactions are most likely to occur. Restrictions to movements of lynx or wolverines during the winter months due to the presence and high levels of use of OSV routes under alternative 3 (up to 720 snowmobiles and 78 snowcoaches) may also limit reproductive success, dispersal, and overall genetic sustainability of the species due to increased frequency of exposure and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under this alternative would be long-term moderate adverse. Cumulative impacts to lynx and wolverines under alternative 3 would be long-term minor to major adverse, of which alternative 3 would contribute a minimal amount.	Under this alternative Sylvan Pass would be closed to OSVs and maintenance activities would cease in the area of the park where human-wolverine interactions are most likely to occur. Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively low levels of use of OSV routes under alternative 4 (up to 110 snowmobiles, 100 wheeled buses, and 30 snowcoaches) would have few impacts on the reproductive success, dispersal, and overall genetic sustainability of the species due to decreased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts under alternative 4 would be short and long-term minor adverse, with long-term beneficial impacts from the removal of human presence at Sylvan Pass. Cumulative impacts under alternative 4 would be long-term minor to major adverse, of which alternative 4 would contribute a minimal amount.	Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively low levels of use of OSV routes under alternative 5 (up to 120 snowcoaches) and the low levels of OSV entry limits at the east entrance would have few impacts on reproductive success, dispersal, and overall genetic sustainability of the species due to decreased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under alternative 5 would be short and long-term negligible to minor, adverse. Cumulative impacts to lynx and wolverines under alternative 5 would be long-term minor to major adverse, to which alternative 5 would contribute minimally.	Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively high levels of use of OSV routes under alternative 6 (up to 540 snowmobiles and 78 snowcoaches), and the potential for higher OSV entry limits at the east entrance would have increased impacts on reproductive success, dispersal, and overall genetic sustainability of the species due to the increased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under alternative 6 would be short and long-term moderate adverse. Cumulative impacts to lynx and wolverines under alternative 6 would be long-term minor to major adverse, of which alternative 6 would contribute a noticeable amount.	This alternative would maintain and allow OSV use in Sylvan Pass, the area of the park where human-wolverine interactions would be most likely to occur. However, daily entrance limits restrict the east entrance to just 22 snowmobiles and 2 snowcoaches per day, (five groups of OSVs), resulting in little use in this area, and minimal disturbance to wolverines. Restrictions on movements of lynx or wolverines during the winter months due to the presence and use of OSV routes in other areas of the park may limit the reproductive success, dispersal, and overall genetic sustainability of the species, but such impacts are difficult to predict. Therefore, impacts predicted under this alternative would be long-term minor adverse, with the potential for moderate adverse impacts if lynx and wolverines travel outside the eastern area of the park. Cumulative impacts to lynx and wolverines under alternative 7 would be long-term minor to major adverse, to which alternative 7 would contribute a small amount.

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Trumpeter Swans/ Eagles	Alternative 1 would result in short- and long-term negligible adverse impacts on swans and eagles in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts. Cumulative impacts would be long-term minor adverse, and alternative 1 would contribute a minimally to the overall cumulative impacts to eagles and swans.	Alternative 2 would limit impacts to swans and eagles through use-limits, guiding requirements, and little overlap of OSV use with the active swan nesting season. Given these conditions and the mitigation measures discussed above, impacts to eagles and swans under alternative 2 would be localized short- to long-term negligible to minor adverse. Cumulative impacts would be long-term minor adverse, and alternative 2 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 3 would limit impacts to swans and eagles as described in alternative 2, but would allow for a greater number of OSVs in the park on a daily basis and would result in short and long-term minor adverse impacts. Cumulative impacts would be long-term minor adverse, and alternative 3 would contribute a noticeable amount to the overall adverse cumulative impact.	Alternative 4 would limit impacts to swans and eagles due to low use limits, reduction in overall motorized vehicle use in the winter within the park, guiding requirements, and little overlap with active swan nesting season. The low use levels and guiding requirements would result in localized short and long-term negligible adverse impacts to eagles and swans under alternative 4. Cumulative impacts would be long-term minor adverse, and alternative 4 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 5 would limit the impacts to swans and eagles through low use limits, guiding requirements, and little overlap between OSV use and the active swan nesting season. The low use levels and guiding requirements would limit impacts to eagles and swans under alternative 5 and result in localized short and long-term, negligible, adverse impacts. Cumulative impacts would be long-term minor adverse, and alternative 5 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 6 would limit impacts to swans and eagles due to use-limits, guiding requirements, and little overlap between OSV use and the active swan nesting season, but would increase OSV use levels on some days beyond current use levels. Impacts to eagles or swans under alternative 6 would be short- and long-term minor to moderate adverse because use levels would increase and up to 25% unguided/non-commercially guided snowmobile use would be permitted. Cumulative impacts would be long-term minor to moderate adverse, and alternative 6 would contribute a noticeable amount to the overall adverse cumulative impacts.	Alternative 7 would limit impacts to swans and eagles through use-limits, guiding requirements, and little overlap of OSV use with the active swan nesting season. Given these conditions and the mitigation measures discussed above, impacts to eagles and swans under alternative 7 would be localized short- to long-term negligible to minor adverse. Cumulative impacts would be long-term minor to moderate adverse, and alternative 7 would contribute minimally to the overall adverse cumulative impacts.
Gray Wolves	Alternative 1 would result in short- and long-term negligible adverse impacts on wolves in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts. The limited human presence would have long-term beneficial impacts. Cumulative impacts would be long-term, minor, adverse, and alternative 1 would contribute a small amount to the overall cumulative impacts.	Alternative 2 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to current use levels, which would reduce the frequency of OSV encounters, and limit the duration of interaction and the approach distance of OSV users due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 2 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 3 would result in short- and long-term minor adverse impacts on wolves in the park because OSV use would increase the frequency and duration of OSV exposure. The guiding requirement regulates the interaction time and approach distance of OSV users, limiting adverse impacts from direct interaction. Cumulative impacts would be long-term minor adverse, and alternative 3 would contribute a noticeable amount to the overall adverse cumulative impacts.	Alternative 4 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because motorized vehicle use would be limited to low use levels, which would reduce the frequency of motorized vehicle encounters with wolves, and limits duration and approach distance of OSV users when encountering wolves due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 4 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 5 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to low use levels which reduces the frequency of motorized vehicle encounters with wolves, and limits duration and approach distance of OSV users when encountering wolves due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 5 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 6 would result in long-term minor to moderate adverse impacts on wolves in the park because OSV use would increase to relatively high use levels, which would increase the frequency of OSV encounters with wolves and the duration of OSV presence. The unguided snowmobile provision may result in improper behavior and decreased approach distance of OSV users when encountering wolves. Cumulative impacts would be long-term minor to moderate adverse and alternative 6 would contribute a noticeable amount to the overall adverse cumulative.	Alternative 7 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to current use levels, which would reduce the frequency of OSV encounters and limit the duration and approach distance of OSV users due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 7 would contribute a small amount to the overall adverse cumulative impacts.
Air Quality	The effects of alternative 1 on air quality and visibility would be long-term negligible adverse. Cumulative impacts would result in long-term minor adverse impacts on air quality.	The effect of alternative 2 on air quality would be long-term minor adverse. The effect of alternative 2 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 3 on air quality would be long-term minor adverse. The effect of alternative 3 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 4 on air quality would be long-term minor adverse. The effect of alternative 4 on visibility would be long-term minor adverse. Cumulative impacts to air quality and visibility would be long-term, minor adverse.	The effects of alternative 5 on air quality would be long-term minor adverse. The effect of alternative 5 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 6 on air quality would be long-term minor adverse. The effect of alternative 6 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 7 on air quality would be long-term minor adverse. The effect of alternative 7 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.

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Soundscapes	The effects of alternative 1 on soundscapes would be long-term, minor to moderate, and adverse due to administrative OSV use. Moderate impacts would be limited to travel corridors. Cumulative impacts to soundscapes would be long-term, minor and adverse.	The effects of alternative 2 on soundscapes would be long-term, moderate and adverse due to the level of OSV use permitted. Cumulative impacts to soundscapes would be long-term, moderate and adverse.	The effects of alternative 3 on soundscapes would be long-term, moderate to major and adverse. Major impacts would be limited to the travel corridor, due to the increased level of OSV use. Cumulative impacts to soundscapes would be long-term, moderate to major and adverse.	The effects of alternative 4 on soundscapes would be long-term, moderate and adverse, due to the permitted level of OSV use. Cumulative impacts to soundscapes would be long-term, moderate and adverse.	The effects of alternative 5 on soundscapes would be long-term, moderate and adverse, both before and after the phase out to snowmobiles only. Cumulative impacts to soundscapes would be long-term, moderate and adverse.	The effects of alternative 6 on soundscapes would be long-term, moderate to major, adverse representing the range between low and high use days under alternative 6. Cumulative impacts to soundscapes would be long-term, moderate to major and adverse.	The effect of alternative 7 on soundscapes would be long-term, moderate adverse. Cumulative impacts to soundscapes would be long-term, moderate and adverse.
Visitor Use and Experience	Restricting winter access to the interior of the park by non-motorized means would result in long-term major adverse impacts on the visitor use and experience. Winter visitors desiring either or both non-motorized and motorized experiences would be affected by loss of access. Overall cumulative effects would be long-term major adverse.	Under alternative 2, continuing OSV use and access in accordance with the 2009 interim rule limits would meet recent demand for winter visitation and provide limited opportunities for growth. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. Resource conditions (i.e., wildlife, soundscapes, and air quality), which support a quality visitor experience, would experience long-term negligible to moderate adverse effects. Therefore, alternative 2 would result in long-term benefits to visitor use and experience. Cumulative impacts to visitor use and experience under alternative 2 would be long-term and beneficial.	Under alternative 3, increasing OSV numbers and allowing access in accordance with the 2004 plan limits would provide opportunities for OSV users to experience Yellowstone in the winter, and would allow for some growth in OSV use as compared to what was observed between 2004 and 2009. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior, but all users could experience a decrease in satisfaction because resources could be impacted by increased OSV use. Resource conditions (i.e., wildlife and soundscapes) would be affected to a greater extent than in recent years and may affect the ability to view wildlife and experience natural sounds. Overall, alternative 3 would result in long-term benefits to visitor experience and access, with long-term minor adverse impacts occurring from any decrease in visitor satisfaction. Cumulative impacts to visitor use and experience under alternative 3 would be long-term and beneficial.	Under alternative 4, changes in visitor access and experience created by introducing wheeled vehicles access and limiting OSV access would result in a distinctively different winter visitor experience. Parkwide, long-term beneficial impacts would result compared with alternative 1. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. However, expectations for OSV access and experience would not likely be met because of the decrease in the number of snowmobiles and snowcoaches permitted in the park on any given day, resulting in long-term moderate adverse impacts for this user group. Overall, alternative 4 would result in long-term beneficial impact and long-term minor to moderate adverse impacts to visitor experience and access. Cumulative impacts to visitor use and experience would be long-term minor to moderate adverse and long-term beneficial.	Under alternative 5, changes in visitor experience created by the potential transition to snowcoach access only would result in parkwide, long-term benefits compared to the no-action alternative. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. However, the opportunity to experience a specific, individual snowmobile experience as offered in the past would be lost. This would result in the potential for visitors' expectations not to be met. Overall, alternative 5 would result in long-term beneficial impacts to visitor experience and access, with long-term moderate adverse impacts to those wishing to engage in snowmobile use. Cumulative impacts to visitor use and experience would be long-term beneficial and long-term moderate adverse.	Under alternative 6, increases in OSV allocations and flexibility in daily use would result in parkwide, long-term beneficial impacts compared to the no-action alternative. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior, and visitors could plan their trip around the use level for that day and their desired experience. Resource conditions (e.g., wildlife and soundscapes) would be affected to a greater extent than in recent years, somewhat affecting the visitors' ability to view wildlife and experience natural sounds. Overall, alternative 6 would result in long-term benefits to visitor experience and access, with potential negligible to minor impacts for visitors that cannot accommodate their desired experience. Cumulative impacts would be long-term minor adverse as well as long-term beneficial.	Under alternative 7, varying OSV allocations and flexibility in daily use would result in parkwide, long-term beneficial impacts compared to the no-action alternative. Visitors could plan their trip around desired use and experiences, but limited OSV availability early and later in the winter season may result in unmet expectations for OSV visitors. Resource conditions (soundscapes and wildlife) would be affected to a lesser extent than in recent years, somewhat improving visitors' ability to view experience natural sounds and view wildlife. Overall, alternative 7 would result in long-term benefits to visitor experience and access, with potential minor to moderate adverse impacts for visitors that cannot obtain their desired experience. Cumulative impacts would be long-term, minor to moderate, adverse, as well as long-term beneficial.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Visitor Accessibility	Restricting winter access to the interior of the park to non-motorized methods would result in long-term major adverse impacts to visitor accessibility; including the very young, the elderly, and the mobility-impaired visitors. Accessible regional opportunities for winter recreation would offset these adverse impacts somewhat. Cumulative impacts to visitor accessibility would be long-term major adverse, to which alternative 1 would contribute a large part.	Under alternative 2, continuing OSV numbers and routes in accordance with the 2009 interim rule limits would meet demand (based on use levels for the 2009/2010 winter season) for accessible winter visitation for the very young, the elderly, and the mobility impaired. Opportunities for increased visitation for those with mobility needs would also be accommodated. Thus, alternative 2 would result in long-term beneficial impacts to visitor accessibility. Cumulative impacts under alternative 2 would be long-term and beneficial.	Under alternative 3, OSV numbers and routes in accordance with the 2004 Winter Use Plan limits would meet the demand (based on use levels for the 2009/2010 winter season) for a winter experience that can be enjoyed by the very young, the elderly, and the mobility impaired. Opportunities for increased accessible visitation would also be accommodated. Therefore, alternative 3 would result in long-term benefits to visitor accessibility. Cumulative impacts under alternative 3 would be long-term and beneficial.	Under alternative 4, distinct accessibility options of snowcoaches, snowmobiles, and wheeled vehicles would be available for exploring Yellowstone in winter. However, accessible snowcoach experiences may not be available to all seeking them. Nonetheless, the availability of wheeled, accessible vehicles would potentially provide the greatest degree of accessibility of the proposed alternatives. This would result in parkwide, long-term beneficial impacts to accessibility when compared to the no-action alternative, with the potential for long-term minor adverse impacts due to the limited availability of snowcoach access. Cumulative impacts would be long-term beneficial.	Under alternative 5, changes in visitor experience created by the potential transition to snowcoach access only would result in parkwide, long-term beneficial impacts compared to the no-action alternative. For those seeking snowmobile experiences, impacts would be long-term, minor to moderate adverse. Cumulative impacts would be long-term and beneficial.	Under alternative 6, total snowcoach allocations would be similar to those in the 2009/2010 winter season. Flexibility in routes and gate entry numbers would potentially increase accessible snowcoach use. This would result in parkwide, long-term beneficial impacts to accessibility compared to the no-action alternative. Cumulative impacts would be long-term and beneficial.	Under alternative 7, OSV allocations would vary within the winter use season, and would be expected to support current and future accessibility demands. This would result in parkwide, long-term beneficial impacts to accessibility compared to the no-action alternative. Cumulative impacts would be long-term and beneficial.
Health and Safety	Overall, air pollution and noise levels would be limited to administrative OSV use and would be minimal, and the closure of Sylvan Pass would reduce the avalanche risk to staff. Therefore, impacts to health and safety would be long-term negligible adverse and long-term beneficial to health and safety, with the potential for long-term minor adverse impacts from the possibility of non-motorized users being out in harsh winter conditions with minimal support facilities. Cumulative impacts would be long-term, negligible adverse.	Under alternative 2, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts under alternative 2 would be long-term minor adverse.	Under alternative 3, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.	Under alternative 4, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term beneficial from the closure of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term negligible adverse.	Under alternative 5, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements, both before and after the transition to snowcoach only. Cumulative impacts would be long-term minor adverse.	Under alternative 6, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor to moderate adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.	Under alternative 7, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Socioeconomic Values	The impacts are estimated to be negligible, adverse, and long term for the three-state area, the five-county area and Cody and Jackson, Wyoming. West Yellowstone is projected to experience minor, adverse, long-term impacts. As described earlier, the adverse direct impacts would be most directly felt by communities and businesses near the park, especially in areas that have a higher proportion of business tied directly to park visitation. At the north entrance, Gardiner, Montana, might experience beneficial impacts if visitors who would have visited the other entrances switch to the North. The IMPLAN modeling captures the indirect and induced effects as well. As individual businesses are adversely affected, they would reduce purchases of other goods and services from suppliers. Conversely if individual businesses are beneficially affected they would increase the purchase of goods and services from suppliers. These feedback effects impact sectors of the economy beyond those that are influenced directly by visitors. Cumulative impacts would be long-term negligible adverse or beneficial cumulative impacts on the socioeconomic environment. In West Yellowstone cumulative negligible to minor adverse impacts could result.	Compared to alternative 1, alternative 2 would result in beneficial, long-term impacts for the three-state area, the five county area, and the communities of Cody and Jackson. In West Yellowstone, the beneficial, long-term impacts would be larger on average. Alternative 2 continues current management, under which there has been some increase in visitation, especially for snowcoach use. Cumulative impacts would be long-term beneficial.	Compared to alternative 1 alternative 3 is expected to result in negligible to beneficial, long-term impacts for the states, counties and communities surrounding Yellowstone. West Yellowstone could experience larger beneficial, long-term impacts compared to the other communities. Alternative 3 has higher daily limits on snowmobile and snowcoach use, and so the alternative could accommodate higher growth in visitation than all the alternatives, except alternative 4. If demand for snowmobile and snowcoach tours grew beyond the current limits, alternative 3 would allow for a larger increase in visitation by out-of-region visitors. However, the lower estimate of visitation is equal to alternative 2 because the snowmobiles must still be part of a guided tour and must meet BAT restrictions. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, all the communities are expected to experience beneficial, long-term impacts and West Yellowstone is expected to experience the largest beneficial impacts. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term beneficial impacts of alternative 4 would result in long-term beneficial cumulative impacts on the socioeconomic environment. The size of the impacts would depend on demand for commercial, wheeled vehicle tours out of the west and north entrances, which would represent a new winter experience for visitors. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, alternative 5 is expected to have on average beneficial, long-term impacts for all the communities, as seen in tables 65, 66 and 67. In order to generate larger beneficial impacts under this alternative, demand for snowcoach tours must increase to more than make up for the eventual phase-out of snowmobiles. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, alternative 6 could provide beneficial, long-term impacts for all the communities, the three-state area, and the five-county area. West Yellowstone could experience larger, beneficial long-term impacts, on average, as reported in tables 65, 66 and 67. The larger beneficial impacts are more likely under this alternative compared to others because of the provision for unguided snowmobile trips, which were historically more popular. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, alternative 7 could provide beneficial, long-term impacts for the three-state area, the five-county area, and the three communities. West Yellowstone could reach larger, beneficial, long term impacts, on average, as reported in tables 65, 66 and 67. Cumulative impacts would be long-term beneficial.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Park Operations and Management	Alternative 1 would have long-term negligible adverse impacts to park operations because staffing and resource requirements would be covered by existing funding, as well as long-term benefits from the potential reallocation of staff to other areas of the park during the winter season. In addition, fuel requirements and green house gas emissions would be reduced from current levels because the number of staff needed in the interior of the park, and therefore OSV use, would be reduced. Cumulative impacts under alternative 1 would be long-term, negligible to minor adverse, of which alternative 1 would contribute a large part.	Alternative 2 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded, and this level of funding would be expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 2 would be long-term negligible to minor adverse, of which alternative 2 would constitute a large part.	Alternative 3 would result in long-term minor to moderate adverse impacts because the staffing and resource requirements would require additional funding that may or may not be available in the park's annual budget. Any additional resources required may impact park operations and could be slightly noticeable to park staff and visitors when resources are allocated from one part of the park to another. Cumulative impacts under alternative 3 would be long-term minor to moderate adverse, of which alternative 3 would constitute a large part.	Alternative 4 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 4 would be long-term negligible to minor adverse, of which alternative 4 would constitute a large part.	Alternative 5 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative as well as the slight increase in funding required over current conditions may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 5 would be long-term negligible to minor adverse, of which alternative 5 would constitute a large part.	Alternative 6 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded (if not slightly lower), and this level of funding expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 6 would be long-term negligible to minor adverse, of which alternative 6 would constitute a large part.	Alternative 7 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to current funding (if not slightly lower), and this level of funding would be expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 7 would be long-term negligible to minor adverse, of which alternative 7 would constitute a large part.

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APPENDICES

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Industrial Hygienists
ADA	American with Disabilities Act
ANSI	American National Standards Institute
ARD	Air Resources Division
AQI	Air Quality Index
AQRV	air quality related value
BAT	best available technology
BBHC	Buffalo Bill Historic Center
BLM	U.S. Bureau of Land Management
BTNF	Bridger-Teton National Forest
CAA	Clean Air Act
CBA	choosing by advantages
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
dbA	decibel (A-weighted)
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FPPA	Farmland Protection Policy Act
GC	glucocorticoids
GHG	greenhouse gas
GIS	Geographical Information System
GPS	Global Positioning System
HAP	hazardous air pollutant
IBMP	Interagency Bison Management Plan
LEED	Leadership in Energy and Environmental Design
MBTA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NPOMA	National Parks Omnibus Management Act
NPS	National Park Service
ORMA	Operational Risk Management Assessment
OSHA	Occupational Safety and Health Administration
OSV	oversnow vehicle

PM	particulate matter
PEL	permissible exposure limit
PEPC	Planning, Environment, and Public Comment
plan/EIS	Winter Use Plan and Environmental Impact Statement
PRB	policy relevant background
PSD	prevention of significant deterioration
REL	recommended exposure limits
SAE	Society of Automotive Engineers
SAT	Science Advisory Team
TLV	threshold limit value
TWA	time-weighted average
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTV	utility-type vehicle
VEC	Visitor Education Center
VOC	volatile organic compound

CHAPTER 1

Purpose of and Need for Action

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

This "Purpose of and Need for Action" chapter describes why the National Park Service (NPS) is taking action at this time with respect to winter use in the interior of Yellowstone National Park (Yellowstone or the park). This draft Winter Use Plan / Environmental Impact Statement (plan/EIS) presents six action alternatives for managing winter use, including oversnow vehicle (OSV) use, and assesses the impacts that could result if the park were to take no action at all (no-action alternative) or implements any of the six action alternatives. Upon conclusion of the draft plan/EIS and decision-making process, the alternative selected for implementation will become the winter use plan, which will specifically address the issue of OSV use in the interior of the park for at least the next 20 years. It will also form the basis for a special regulation to manage OSV use in the park should an alternative be selected that allows OSV use to continue.

Specifically, this chapter includes the following:

- Statements of the purpose of and need for taking action, as well as objectives in taking action developed during internal and public scoping;
- A description of the project study area;
- A description of the purpose and significance of the park;
- A description of the history and management of winter use in the park, with a focus on OSV management;
- Related laws, policies, plans, and other constraints; and
- A discussion of issues and impact topics identified during the scoping process and considered in preparation of this draft plan/EIS, as well as issues and impact topics dismissed from further analysis.

PURPOSE OF THE PLAN

The purpose of this draft plan/EIS is to establish a management framework that allows the public to experience the unique winter resources and values at Yellowstone National Park. This draft plan/EIS will be used to determine whether motorized winter use in the interior of the park (including wheeled motor vehicles, snowmobiles, and snowcoaches) is appropriate, and if so, the type, extent, and location of this use.

*"**Purpose** is a statement of goals and objectives that NPS intends to fulfill by taking action."*
Director's Order 12, Section 2.2(A)

NEED FOR ACTION

*"**Need** is a discussion of existing conditions that need to be changed, problems that need to be remedied, decisions that need to be made, and policies or mandates that need to be implemented. In other words, it explains why [the] park is proposing this action at this time."*
Director's Order 12, Section 2.2(B)

The NPS provides opportunities for people to experience the park in the winter, but access to most of the park in the winter is limited by distance and the harsh winter environment, which presents challenges to safety and park operations. The park offers unique winter experiences that are distinct from other times of the year. In the past, the park has provided access to OSV users; however, the legal authority for OSV use (snowmobiles and snowcoaches) at Yellowstone expired on March 15, 2011. Therefore the park is developing this plan because a decision is needed about whether OSV use should continue, and if so, how to direct use to protect resources and values, and how to provide for visitor use and enjoyment.

OBJECTIVES IN TAKING ACTION

Objectives are what must be achieved to a large degree for the action to be considered a success under Director's Order 12 (NPS 2001). All alternatives selected for detailed analysis in this draft plan/EIS meet the objectives to a large degree and resolve the purpose of and need for action. Objectives for managing winter use at Yellowstone are grounded in the park's enabling legislation, purpose, significance, and the goals of the park as stated in planning documents. Objectives are also compatible with direction and guidance provided by the park's strategic plan, 1995 Natural Resources Management Plan, 1974 Master Plan, and other management guidance. The objectives for managing winter use at Yellowstone are stated below.

***Objectives** are "…goals the park must accomplish by taking action for the action to be considered a success." Director's Order 12, Section 2.1, Item 2*

VISITOR USE

- Provide the opportunity for visitors to experience and be inspired by Yellowstone's unique winter resources and values while ensuring resource protection.
- Increase visitor understanding and appreciation of the park's winter resources.
- Provide access for winter opportunities in the park that are appropriate and universally accessible.

RESOURCES

- Wildlife: Manage winter use so that it does not disrupt the winter wildlife ecology, including sensitive species.
- Sound: Manage winter use to protect naturally occurring background sound levels and to minimize loud noises.
- Air Quality: Manage winter use to minimize impacts to resources that may be affected by air pollution including visibility and aquatic systems.
- Wilderness: Manage winter use to protect wilderness character and values.
- Develop and implement an adaptive management program that includes monitoring the condition of resources.

HEALTH AND SAFETY

- Manage access in the winter for the safety of all visitors and employees, including limiting impacts from emissions, noise, and known hazards.

COORDINATION AND COOPERATION

- Improve coordination and communication regarding winter use management with park partners, gateway communities, and other stakeholders.

PARK MANAGEMENT/OPERATIONS

- Promote advances of vehicle technology (OSVs and commercial wheeled vehicles) that will reduce impacts and facilitate continuous improvement of technology over time.
- Provide for winter use that is consistent with the park priority to provide critical visitor services at core locations.

PROJECT STUDY AREA

The geographic study area for this draft plan/EIS is Yellowstone National Park within the states of Wyoming, Montana, and Idaho, (see figure 1) unless otherwise noted under each resource topic.

PURPOSE AND SIGNIFICANCE OF YELLOWSTONE NATIONAL PARK

National park system units are established by Congress to fulfill specified purposes. A park's purpose provides the foundation for decision-making as it relates to the conservation of park resources and providing for the "enjoyment of future generations."

Congress established Yellowstone National Park to "dedicate and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people; … for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition" (U.S. Congress 1872). Yellowstone National Park's purpose and significance are rooted in its enabling legislation (as described further under "Related Laws, Policies, Plans, and Constraints"), subsequent legislation, and current knowledge of its natural, cultural, and visual resources. Statements of a park's significance describe why the park is important within a global, national, regional, and ecosystem-wide context and are directly linked to the purpose of the park. Yellowstone National Park is significant for the following reasons:

- It is the world's first national park.
- It preserves geologic wonders, including the world's most extraordinary collection of geysers, hot springs, and the underlying volcanic activity that sustains them. Yellowstone National Park is positioned on a "hot spot" where the earth's crust is unusually thin and molten magma rises relatively close to the surface.
- It preserves abundant and diverse wildlife in one of the largest remaining intact and wild ecosystems on earth, supporting surrounding ecosystems and serving as a benchmark for understanding nature.

Hot Spring in Winter

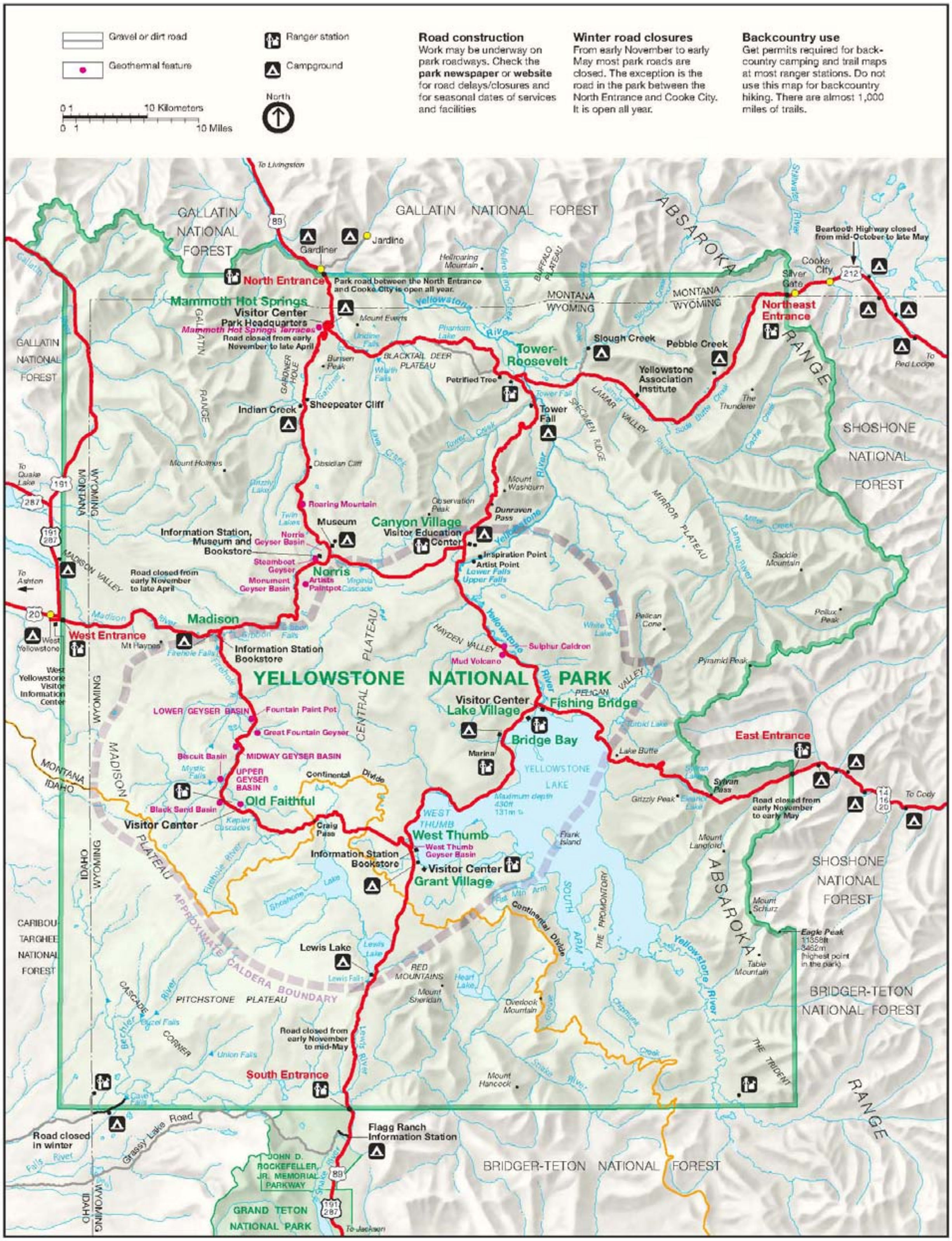


FIGURE 1: YELLOWSTONE NATIONAL PARK MAP

- It preserves an 11,000-year continuum of human history, including sites, structures, and events that reflect our shared heritage. This history includes the birthplace of the national park idea—a milestone in conservation history.
- It provides for the benefit, enjoyment, education, and inspiration of this and future generations. Visitors have a range of opportunities to experience the essence of Yellowstone National Park's wonders and wildness in a way that honors the park's value to the human spirit and deepens the public's understanding and connection to it.

SUMMARY OF OVERSNOW VEHICLE MANAGEMENT AT YELLOWSTONE NATIONAL PARK

Winter use in Yellowstone, specifically issues related to OSVs, has been the subject of debate for more than 75 years. At least 12 times since 1930, the NPS and park stakeholders have formally debated what the park should look and be like in winter. Interest in accessing the park in the winter began in the early 1930s and grew throughout the years. In the 1970s, 1980s, and early 1990s, snowmobile use in the park grew consistently, with the use of snowcoaches following in popularity. Historically, the increase in the use of these vehicles accessing the park, collectively known as OSVs, brought unanticipated problems including air and noise pollution, conflicts with other users, and wildlife harassment, as documented in past planning efforts. To address these problems, planning for the management of OSV use began with the Master Plan in 1974. Since then, a series of planning processes have examined winter use in Yellowstone. A detailed description of these processes can be found on the park's winter use website at http://www.nps.gov/yell/planyourvisit/winteruse.htm.

Recently, as a result of litigation over the 2007 planning effort, on September 15, 2008, the U.S. District Court for the District of Columbia vacated the 2007 Winter Use Plan and Final Environmental Impact Statement, as well as the associated Record of Decision and rule. Because the court's ruling left no provision in place for snowmobile or snowcoach use (effectively meaning that OSV use would not be allowed in the park because there was no rule to support it), the NPS issued the Interim Winter Use Plan / Environmental Assessment on November 3, 2008. A proposed rule was published on November 5, 2008.

However, on November 7, 2008, the U.S. District Court for the District of Wyoming issued an order reinstating the 2004 rule, allowing snowmobile and snowcoach use in Yellowstone until a new rule could be completed. For the winter of 2008/2009, the park operated under the 2004 rule which allowed up to 720 snowmobiles and 78 snowcoaches per day. The Wyoming decision was appealed, but the litigation was declared moot by the 10th Circuit Court of Appeals because the NPS had already developed an interim plan and promulgated a replacement rule.

In 2009, the NPS completed a new Interim Winter Use Plan Finding of No Significant Impact and promulgated a new interim rule. The interim plan and rule allowed access for up to 318 snowmobiles and 78 snowcoaches into Yellowstone per day during the 2009/2010 and 2010/2011 winter seasons. It continued to require all snowmobiles and snowcoaches to be commercially guided and snowmobiles were required to meet best available technology (BAT) requirements.

In addition, the rule provided for motorized OSV travel over Sylvan Pass and Yellowstone's east entrance road as agreed to by the Sylvan Pass Study Group (the NPS, state of Wyoming, Park County, Wyoming, and the City of Cody). The interim plan and rule did not allow snowmobile and snowcoach use after March 2011.

The 2009 interim plan and rule (allowing for up to 318 snowmobiles and 78 snowcoaches per day) were challenged by the State of Wyoming and Park County, Wyoming. On September 17, 2010, the Wyoming court issued a ruling in favor of the NPS on the interim plan and rule, which expired on March 15, 2011, following the close of the 2010/2011 winter season.

SUMMARY OF SCIENTIFIC LITERATURE ON OVERSNOW VEHICLE USE

The information presented in this draft plan/EIS, including information in the “Affected Environment” and “Environmental Consequences” chapters, was developed based on best available information regarding the resources at Yellowstone. To support the wealth of existing information, three additional processes were undertaken to assist in the development of this draft plan/EIS, as described below.

SCIENTIFIC ASSESSMENT OF YELLOWSTONE NATIONAL PARK WINTER USE

The Scientific Assessment of Yellowstone National Park Winter Use is available at the Yellowstone Winter Use website at http://www.nps.gov/yell/planyourvisit/winteruse.htm and the Planning, Environment, and Public Comment website at http://parkplanning.nps.gov/yell. The Scientific Assessment refers to available scientific information related to the potential effects of OSV use on natural resources.

SCIENCE ADVISORY TEAM

The Superintendent of Yellowstone established a Science Advisory Team (SAT) to support the development of this draft plan/EIS. The SAT charter specified the following primary goals:

1. Enhance the accountability and integrity of Yellowstone’s scientific assessments of impacts from winter use activities on park natural resources.
2. Provide additional scientific interpretation of existing research to support analysis in new National Environmental Policy Act (NEPA) documents and long-term winter use management plans.
3. Provide scientific recommendations for the experimental designs and adaptive management methodologies for monitoring changes in impacts to park resources, values, and visitor experience resulting from managed winter use.
4. Integrate and interpret scientific results to provide regular updates on the best available assessment of the consequences of winter use for park resources, values, and visitor experience.
5. Ensure science is accurately represented and integrated into decision making. The SAT will provide independent peer review of scientific information to meet Department of the Interior and NPS mandates under the Information Quality Act.

The Scientific Assessment of Yellowstone National Park Winter Use was informed by facilitated workshops with natural resource and social science experts in February 2010, air quality experts in May 2010, and acoustics and soundscape experts in July 2010. Additionally, the SAT identified important issues based on their best professional judgment in a series of facilitated conference calls throughout the winter and summer of 2010. The U.S. Geological Survey Northern Rockies Science Center completed a peer review of this report according to established U.S. Geological Survey Fundamental Science Practices.

OPERATIONAL RISK MANAGEMENT ASSESSMENT

Additional supporting information for this winter use planning process was provided from the Operational Risk Management Assessment process that occurred for the operation of Sylvan Pass in August 2010. This review was a follow up to the initial Operational Risk Management Assessment conducted in 2007. A panel of experts evaluated the risks to employee and visitor safety as reflected by the existing operations that were initiated in 2007, as well as the potential gains (for visitor access, agency cost, resource protection, and effectiveness of avalanche control) of several new and different potential avalanche control options, with the operation's mission being to avoid negative avalanche-human contact. This information was considered and incorporated into the health and safety section of this document.

ISSUES AND IMPACT TOPICS

NEPA regulations require an "early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Issues are problems, opportunities, and concerns regarding the current and potential future management elements for managing winter use, impacts of winter use, and winter use opportunities in Yellowstone that are included in this draft plan/EIS. The issues were identified by the NPS, cooperating agencies, other agencies, and the public throughout the scoping process. Public scoping began on January 29, 2010, with the publication of a Notice of Intent in the Federal Register. During the scoping period, six public scoping open houses were held in Idaho (1), Montana (2), Wyoming (2), and Washington, D.C. (1), with subsequent webinars and public conference calls introducing the range of alternatives. The public scoping period closed on March 30, 2010; the NPS received more than 9,000 comments on the scope of this draft plan/EIS. Comments received included suggestions for alternative elements (should OSV be allowed in the park, how many OSV should be allowed in the park, what should BAT and guiding requirements look like, should wheeled vehicles be permitted in the interior of the park, etc.). Additional comments included impact topics that should be considered, such as wildlife, air quality, soundscapes, and visitor use.

Issues*— The issues were identified by the NPS, cooperating agencies, other agencies, and the public throughout the scoping process.*

Impact topics are a more refined set of concerns analyzed for each of the winter use alternatives. The impact topics were derived from issues. Each impact topic is explained in the "Affected Environment" chapter. In the "Environmental Consequences" chapter, the impact topics were used to explain the extent to which an issue would be made better or worse by the actions of a particular alternative.

Public Scoping Meeting Held in Idaho Falls, Idaho

WILDLIFE AND WILDLIFE HABITAT, INCLUDING RARE, UNIQUE, THREATENED, OR ENDANGERED SPECIES, AND SPECIES OF CONCERN

Various elements of the alternatives evaluated, including the use of snowmobiles, snowcoaches, OSV road grooming, and wheeled vehicles/plowed roads, on wildlife in the interior of the park, have the potential to impact the park's wildlife. Specifically, the species below were selected for detailed analysis in this draft plan/EIS, due to the potential impacts of winter use.

Bison Foraging in Winter

Winter use of the park by ungulates such as elk and bison is widespread, and herds of these large ungulates are focal points for visitors. Elk and bison in the park are the subject of numerous studies relating to OSV use. They are potentially subject to encounters and conflicts with OSV users and other winter visitors, and are brought up as a species of concern by the public during scoping. These two ungulates are therefore retained for analysis in this draft plan/EIS. Three species, Canada lynx (*Lynx canadensis*), grizzly bear (*Ursus arctos horribilis*), and gray wolf (*Canis lupus*) are listed or treated as threatened (they are species of special concern in the park) under the Endangered Species Act (ESA). Grizzly bears are unlikely to experience adverse effects from OSV use, and were therefore not further evaluated in this draft plan/EIS (see "Issues Considered but Dismissed from Further Analysis" (page 11)). Canada lynx and gray wolf; however, have been carried forward for analysis because they could be impacted from OSV use and associated actions. Additional species of concern that could be adversely affected by OSV use and its associated actions and are relatively rare in the park or in need of special protection include the wolverine (*Gulo gulo*), bald eagle (*Haliaeetus leucocephalus*), and trumpeter swan (*Cygnus buccinator*). Other species or categories of species that were mentioned in scoping or previous NEPA analyses but that would not experience adverse impacts greater than minor and/or are not rare or in need of special protection are discussed in "Issues Considered but Dismissed from Further Analysis," below (see page 11).

AIR QUALITY

Section 4.7.1 of NPS *Management Policies 2006* (NPS 2006a) states that the NPS has a responsibility to protect air quality under the NPS Organic Act of 1916 and the Clean Air Act of 1970 and its amendments. The management policies also note that the NPS actively promotes and pursues measures to protect air-quality related values from the adverse impacts of air pollution and seeks to protect integral vistas (those views perceived from within certain national parks of a specific landmark or panorama outside the park), through cooperative means.

Air quality is a key resource in itself as well as a highly prized (and expected) element of the park visitor experience. Potential impacts to air quality from winter use in Yellowstone include air-quality related issues from exhaust as well as visibility (particularly from OSV emissions). During public scoping for this planning effort and during past planning efforts, public and cooperating agency commenters raised concern about air emissions from the various forms of OSV travel, as well as suggestions for how air quality should be analyzed in the draft plan/EIS (consideration of new technologies, development of an air monitoring protocol, among others).

Because of the potential impacts of snowmobile, snowcoach, and/or bus travel on air quality, including emissions, visibility, and air-quality related values, impacts to air quality are assessed in this draft plan/EIS.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

Section 4.9 of the NPS *Management Policies 2006* (NPS 2006a) states that the NPS will preserve, to the greatest extent possible, the natural soundscapes of the park, both biological and physical. Natural sounds are intrinsic elements of the environment that are vital to the functioning of ecosystems and can be used to determine the diversity and interactions of species within communities. Soundscapes are often associated with parks and are considered important components of the visitor experience as well as natural wildlife interactions.

Whenever OSV use occurs in the park, winter soundscapes in Yellowstone consist of both natural and non-natural sounds. During public scoping for this planning effort and during past planning efforts, public and cooperating agency commenters raised concern about the noise levels of various forms of OSV travel.

Because of the potential impacts of snowmobile, snowcoach, and bus travel on the park's natural soundscape, impacts to soundscapes and the acoustic environment are assessed in this draft plan/EIS.

VISITOR USE AND EXPERIENCE

Issues related to visitor use are addressed in Section 7 of NPS *Management Policies 2006* (NPS 2006a). The vast majority of winter visitors use OSVs to access the interior of the park. For some, these vehicles are an integral component of their experience. Others perceive negative impacts from OSV use, even if they used OSVs to access the park. Public input from this and past planning efforts has shown that expectations for a winter visitor experience in the interior of Yellowstone vary among visitors. At issue is the nature of visitor enjoyment and its relationship to the management and conservation of park resources and values.

Example of the Visitor Experience in Yellowstone in the Winter

Because of the potential for the impacts of snowmobile, snowcoach, and bus travel on park visitor use and experience, impacts to soundscapes and the acoustic environment are assessed in this draft plan/EIS.

VISITOR ACCESSIBILITY

It is NPS policy to ensure that all people, including those with disabilities, have the highest reasonable level of accessibility to NPS programs, facilities and services. NPS *Management Policies 2006* emphasize the need to provide access to persons with disabilities in section 8.2.4, which states, "This policy reflects the commitment to provide access to the widest cross section of the public, and to ensure compliance with the intent of the Architectural Barriers Act of 1968 and the Rehabilitation Act of 1973. The Service will also comply with section 507 of the Americans with Disabilities Act (42 USC 12207), which relates specifically to the operation and management of federal wilderness areas. Other areas of NPS *Management Policies 2006* that address access are the need to comply with the Americans with Disabilities Act and Architectural Barriers Act in Section 5.3.2 and Physical Access for Persons with Disabilities in Sections 1.9.3, and 9.1.2. Other mandates include the requirement to provide reasonable accommodation to known disabilities of qualified applicants and employees (Director's Order 16A, Reasonable Accommodation for Applicants and Employees with Disabilities) and to ensure that facilities are readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs (Director's Order 42, Accessibility for Visitors with Disabilities in National Park Service Programs and Services). During public scoping for this planning effort and during past planning efforts, public and cooperating agency commenters noted the role that various forms of access (snowcoaches, snowmobiles, and wheeled vehicles) play in providing visitors access to the winter experience in the interior of the park.

This draft plan/EIS considers and analyzes the potential impacts resulting from changes to accessibility to the interior of the park for the very young, the elderly, and those who are mobility challenged. For these individuals, mobility issues were not considered to be of primary concern; rather, opportunities to access and experience the park, view wildlife and scenery, exposure to winter weather including cold temperatures and high winds, and the need for protection from these elements were considered.

HUMAN HEALTH AND SAFETY

Section 8.2.5.1 of the NPS *Management Policies 2006* (NPS 2006a) states that the saving of human life will take precedence over all other management actions as the NPS strives to protect human life and provide for injury-free visits. During public scoping for this planning effort and during past planning efforts, public and cooperating agency commenters indicated concerns for safety regarding the operation of Sylvan Pass, as well as noted potential safety benefits with road plowing in the interior of the park.

Health and safety issues associated with some of the actions under consideration in this draft plan/EIS include the effect of motorized vehicular emissions and noise on employees and visitors, avalanche hazards, and safety problems where different modes of winter transport are used in the same place or in close proximity. Because of these potential impacts to health and safety, this topic is analyzed in detail in this draft plan/EIS.

SOCIOECONOMIC VALUES

Under Section 8.11 of the NPS *Management Policies 2006* (NPS 2006a), the NPS is required to facilitate social science studies that support the NPS mission by providing an understanding of park visitors, the non-visiting public, gateway communities and regions, and human interactions with park resources. This approach provides a scientific basis for park planning, development, operations, management, education, and interpretive activities.

During this and past planning efforts, public and cooperating agency commenters indicated concern about the potential economic impacts of changing the management of winter use in the park on local businesses. The gateway communities of the park are dependent, in part, on winter use of the park, and any change in management during the winter use period could impact revenue for local businesses. Concerns have also been voiced over affordable access, diversification of gateway community economies, protection of local business opportunities, and a need for additional socioeconomic surveys. Because of the potential impacts on socioeconomics, this topic is analyzed in detail in this draft plan/EIS.

PARK WINTER OPERATIONS AND MANAGEMENT

Due to the harsh environmental conditions, management of winter use in the interior of Yellowstone requires a sufficient number of personnel and an adequate level of funding. Experience has shown managing winter use in the park presents logistical and financial challenges. Any changes to winter use in the park could change the level of park staff and time and other resources required, and could increase the commitment of limited NPS resources (staff, money, time, and equipment). During public scoping for this planning effort and during past planning efforts, public and cooperating agency commenters raised concern about the amount of staff and resources needed to carry out each alternative. Because of the potential impacts to park operations from the alternatives under consideration in this draft plan/EIS, this topic is analyzed in detail.

ISSUES AND IMPACT TOPICS CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

As described in the "Environmental Consequences" chapter in this draft plan/EIS, the NPS takes a "hard look" at all potential impacts by considering the direct, indirect, and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. In those cases where impacts are either not anticipated or are expected to be minor or less, the issues and impact topics are dismissed from detailed analysis. As described in NEPA regulations, NEPA analysis should focus on issues that are truly significant to the action in question, rather than amassing needless detail (Council on Environmental Quality (CEQ) NEPA regulations, 40 CFR 1500.1 (b)). This section identifies the issues and impact topics dismissed from detailed analysis in this draft plan/EIS and provides the rationale for the dismissal. Generally, issues and impact topics are dismissed from detailed analysis for one or more of the following reasons:

- The resource does not exist in the analysis area.
- The resource would not be affected by the proposal, or the likelihood of impacts are not reasonably expected (i.e., no measurable effects)
- Through the application of mitigation measures, there would be minor or less effects (i.e., no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

The NPS uses the concept of "no measurable effects" to determine whether impact topics are dismissed from further evaluation to concentrate its analyses on issues that are truly significant to the action in question, rather than amassing needless detail (CEQ NEPA regulations, 40 CFR 1500.1(b)).

For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct, indirect, and cumulative effects is presented.

GEOLOGIC RESOURCES (SOILS, BEDROCK, STREAMBEDS, ETC.) INCLUDING GEOTHERMAL RESOURCES

Section 4.8 of the NPS *Management Policies 2006* (NPS 2006a) addresses geologic resource management, including geologic features and process. This policy states that the NPS will (1) assess the impacts of natural processes and human activities on geologic resources; (2) maintain and restore the integrity of existing geologic resources; (3) integrate geologic resource management into NPS operations and planning; and (4) interpret geologic resources for park visitors. Visitor access to the park's geologic and geothermal features in the winter months occurs via OSV on existing paved roads covered by snow. OSVs are the primary means of transportation to these sites in the interior of the park. Because any OSV or wheeled vehicle use under consideration in this draft plan/EIS would occur only on existing snow covered paved roads (the same roads open to wheeled vehicle traffic in the summer), with access to foot traffic along established boardwalks, geologic or geothermal resources would not be affected or disturbed. Therefore the potential impacts to geologic and geothermal resources from the range of alternatives evaluated are dismissed from further analysis in this draft plan/EIS.

Topography and soils are considered geologic resources. Geology is a major determinant of water and soil chemistry, the type of plants that will grow and thrive, and the stability of hillsides. The topography and soils of the park would not be impacted by the alternatives being considered in this draft plan/EIS; OSV use as proposed under the action alternatives would not impact topography or soils. Any proposed OSV or wheeled vehicle use in the park under consideration in this draft plan/EIS would occur on existing paved roads, which are the same roads open to wheeled vehicle traffic in the summer. Therefore, implementation of a winter use plan would not disturb topography or soils because OSV traffic would not directly access soils or topographic features. Because no impacts would occur to soils or topography, the potential impacts to these resources have been dismissed from further analysis in this draft plan/EIS.

GEOHAZARDS

A geohazard is an event related to geological features and processes that cause loss of life and severe damage to property and the natural and built environment, such as an earthquake or rock slide. Although geohazards, such as earthquakes, do occur in the park, they would not impact or be impacted by the implementation of any of the alternatives under consideration in this plan. Therefore, this topic is dismissed from further consideration in this draft plan/EIS.

OTHER WILDLIFE AND WILDLIFE HABITAT

Issues and concerns about impacts to wildlife were raised during scoping and during the preparation of this and previous NEPA documents relating to OSV use in the park. These concerns centered on certain species that could be adversely affected by OSV use and/or that have been studied in relation to OSV use. As discussed earlier in this chapter, those species are included in the plan for detailed analysis. This section refers to other species that are expected to be minimally affected by the alternatives considered in this draft plan. These species or categories of wildlife, and the reason for their dismissal from detailed analysis, are discussed below.

Grizzly Bear (*Ursus arctos horribilis*)

The greater Yellowstone area grizzly population is considered a distinct population segment and increased from a low of 136 animals in 1975 to more than 500 bears in 2010 (USFWS 2010a). This increase occurred during periods of heavy OSV use, when visitor numbers in the park varied from 70,000 to 100,000 each winter. The current population of grizzly bears in Yellowstone is estimated at between 431 and 588 in the Yellowstone ecosystem (NPS 2010a), and Yellowstone’s grizzly bear population is currently listed as threatened (USFWS 2010a).

Grizzly bears are not active during the winter, but OSV- related activities could disturb them during hibernation or after emergence in the spring, which could occur as early as mid-February. In fall, grizzlies are in hyperphagia, an annual phase in which they gorge themselves on available foods in preparation for hibernation. Females are the first to den, starting in the first week of September, with 90% of female grizzlies denned by the end of November. The earliest den entry recorded for male grizzlies was the second week of October, with 90% denned by the fourth week of November. Dens are often found in north slopes, usually at altitudes from 6,500 to 10,000 feet (averaging 8,100 feet) close to whitebark pine and/or subalpine fir forests (McNamee 1984; Judd et al. 1986). In spring, males are first to emerge from winter hibernation, starting as early as mid-February, and females with cubs emerge usually by mid-April (Haroldson et al. 2002). Spring-emerging bears consume ungulate carcasses, when available, and rely on these carcasses as a primary food source while also consuming whitebark pine nuts, spring vegetation, and over-wintered whitebark pine nuts, if available (Mattson et al. 1991; Mattson et al. 1992).

Grizzly bears are sensitive to human disturbance at den sites and Mace and Waller (1997) speculated that female grizzly bears with cubs that are still confined to the den site in the spring have the greatest potential to be disturbed by OSV use. OSV use in Yellowstone is restricted to groomed road corridors and occurs from late December to early March, when most female grizzlies are still denned. Male grizzly bears are the earliest to emerge in the spring, and may overlap with OSV use in the park.

Impacts of human recreation on bears is mitigated by park established bear management areas, where human disturbance is limited by total closure of an area, trail closure, a minimum party size of four or more people, and human travel restrictions to daylight hours only. Bear management areas are designed to reduce the impacts of human disturbance in high-density bear habitat. Areas with denning females are closed from the start of spring emergence, generally March 1 (NPS 2010a). These closures would serve to further protect den sites from winter use extending until March 10.

Grizzly bears in Yellowstone generally den far from groomed park roads and areas used by recreationists, and are in hibernation for most of the winter months. Therefore, OSV and wheeled vehicle use as proposed in this draft plan/EIS in the park has little potential to disturb them. Although there is overlap with the proposed winter use season (which extends through March 10) and spring emergence (which can occur as early as mid-February), female grizzlies with cubs, which may be the most sensitive to disturbance, generally do not emerge until after winter use season has ended or areas with denning females are closed, generally March 1 (NPS 2010a). Additionally, grizzly populations were increasing in the park during winter use periods, including periods of heavy OSV use prior to 2004 and the continued, but reduced, OSV use during the following winters. Whitebark pine decline in the area may result in changes in bear ecology; however, specifics of how this may affect denning chronology are unknown. All alternatives for winter use management would have, at most under the action alternatives (alternatives 2, 3, 4, 5, 6, and 7), short-term negligible adverse impacts on grizzly bears, because encounters between OSVs and grizzly bears is limited, both by seasonal timing and by the restriction of OSV users in the park to groomed roads. Under the no-action alternative (alternative 1), no affects would be assumed from the limited administrative use that would occur. Therefore, potential impacts on grizzly bears from the alternatives under consideration in this plan are not analyzed in further detail.

Black Bear (*Ursus americanus*)

Previous analysis has demonstrated that existing winter recreation activities in the park does not affect black bears. Destruction of den sites or den habitat does not appear to be an issue in the park. Bears are not being disturbed while they are preparing or occupying den sites (Reinhart and Tyers 1999; Podruzny et al. 2002; Haroldson et al. 2002). The main concern is the potential for bear-human conflicts and displacement of bears while they are foraging during the pre-denning and post-emergence periods. The current winter recreation season in the park does not overlap with most bear activity and, therefore, precludes most risks of bear-human conflicts. For these reasons, impacts on black bear would be no more than short-term negligible adverse under all alternatives considered in this draft plan/EIS. Therefore, potential impacts on black bears from the alternatives under consideration in this plan are not analyzed in further detail.

Cougar

Cougars are secretive predators, weighing from 75 to 165 pounds as adults, that primarily prey on elk calves and mule deer in northern Yellowstone. Cougars actively avoid encounters with humans and are rarely seen by park visitors. In 1987, the park began a two-phase study investigating the ecology, population, and movements of cougars in northern Yellowstone. Phase I took place from 1987 to 1996 and during this time researchers captured 88 cougars, 80 of which were radio collared and tracked. Phase II of the study began in 1998 and investigated the ecological role of cougars in the greater Yellowstone area ecosystem. Results of this research provide a good estimate of cougar population, and their role in the ecology of Yellowstone. Yellowstone's northern range currently supports an estimated population of 14 to 23 adult cougars and numerous kittens. Human hunting, habitat fragmentation, and habitat loss are the primary threats to cougar populations in the greater Yellowstone area (Greater Yellowstone Science Learning Center 2010). Cougars are primarily found in the northern section of the park, where proposed OSV road corridors would be limited. Therefore, exposure to OSVs under the alternatives in this draft plan/EIS would be rare and impacts to cougars from OSV use in the park would be short-term, negligible to minor adverse under the action alternatives (alternatives 2, 3, 4, 5, 6, and 7). The short-term minor adverse impacts expected under alternative 3 would be due to the higher amount of OSV use. The short-term minor adverse impacts expected under alternative 6 would be due to the allowance for non-commerically guided/unguided use. Under the no-action alternative (alternative 1), no affects would be assumed from the limited administrative use that would occur. Therefore, potential impacts on cougars from the alternatives under consideration in this plan are not analyzed in further detail.

Coyote

Coyotes are abundant, successful, and highly adaptable predators and scavengers found in most habitats below 8,000 feet throughout the greater Yellowstone area. Coyotes are adaptable to human use and appear to thrive in disturbed areas. During winter behavioral observations in 2009, coyotes generally displayed a look-resume response to OSV traffic (47%), with 30% showing no visible response, 12% travel, and 12% alarm-attention (McClure et al. 2009). OSV use has not been linked to declines in population or to changes in habitat use. Rather than demonstrating increased sensitivity, the coyote appears generally prone to lose its fear of humans and frequent areas of human use, searching for food or begging (Taber 2006; Van Etten et al. 2007).

The guiding requirements presently in place at Yellowstone appear to have eliminated most begging behavior. Visitors are instructed to store their food in closed compartments and to refrain from feeding begging coyotes. Additional measures include securing trash cans and areas of human food waste at developed sites. The primary issue regarding impacts of OSV use on coyotes is the effect of unguided users feeding or not securing food from scavenging coyotes (Taber 2006).

Because there is no OSV use under the no-action alternative, no effects are assumed under alternative 1. Alternatives 2, 3, 4, 5, and 7 include commercial guiding requirements, with trained drivers operating both snowcoaches and wheeled buses, and guides leading groups of up to 11 snowmobiles. This commercial guiding requirement reduces the possibility for problem behaviors in coyotes because trained commercial guides would continue to instruct their clients regarding food storage and feeding. Also, under these alternatives, daily entry requirements limit OSV visitation levels to a level below historical limits. Most impacts to coyotes increase with increased vehicle numbers, so this measure would limit such impacts. Also, monitoring of human-wildlife encounters would continue under these alternatives. If this monitoring indicates that the presence and activities of winter visitors are having unacceptable impacts on coyotes that cannot be mitigated, selected areas of the park may be closed to visitor use. Therefore, alternatives 2, 3, 4, 5, and 7 would result in short-term negligible adverse effects on coyotes.

Under alternative 6, up to 25% of snowmobiles would enter the park unguided or non-commercially guided, increasing the likelihood of visitor-wildlife interactions. Although attempts would be made to educate unguided visitors about proper wildlife interactions, this may not be as effective as commercial guides ensuring visitor compliance. Similar to the other action alternatives, monitoring of human-wildlife encounters would continue. If this monitoring indicates the presence and activities of winter visitors are impacting coyotes, selected areas of the park may be closed to visitor use to mitigate the potential impacts. Alternative 6 would, therefore, be expected to have short-term minor adverse effects on coyotes.

Impacts to coyotes under all alternatives would be no more than minor impacts from OSV use. Therefore, potential impacts on coyotes from the alternatives under consideration in this plan are not analyzed in further detail.

Other Mid-Sized Carnivores

Other mid-sized carnivores not addressed further in this analysis include the bobcat, fisher, marten, long-tailed weasel, and red fox. The reason for dismissal of these species is discussed below. The wolverine and Canada lynx are included in the detailed analysis in this draft plan/EIS.

The bobcat and red fox are managed as furbearers in the greater Yellowstone area, and thus may be hunted and trapped. Populations are considered stable (Olliff et al. 1999). OSV use as proposed under the alternatives considered in detail in this draft plan/EIS would occasionally interact with these species, but such interactions would be rare. Therefore, interactions with OSVs would have short-term negligible to minor adverse impacts on the population of red fox and bobcat in the park under the action alternatives (alternatives 2, 3, 4, 5, 6, and 7). The short-term minor adverse impacts expected under alternative 3 would be due to the higher amount of OSV use and the impacts under alternative 6 would be due to the allowance for non-commerically guided/unguided use. Under the no-action alternative (alternative 1), no affects would be assumed from the limited administrative use that would occur. Therefore, potential impacts on bobcat and red fox from the alternatives under consideration in this plan are not analyzed in further detail.

Fishers live in coniferous and mixed conifer and hardwood forests and prefer mature or old-growth forest cover. During winter in the greater Yellowstone area, fishers avoid areas of deep, fluffy snow and select riparian areas with relatively gentle slopes and dense canopy cover that may provide protection from snow (USFWS 2010b; Clark et al. 1989). Fishers are active throughout the winter and are opportunistic predators primarily of snowshoe hares, porcupines, squirrels, mice, and birds. Fishers also consume carrion and plant material (e.g., berries). The breeding season is from March to April (Heinemeyer and Jones 1994). Due to concern about the status of fishers, and lack of available information on their population, on April 15, 2010, the U.S. Fish and Wildlife Service (USFWS) determined that the Northern Rocky Mountain distinct population of the fisher may warrant federal protection as a threatened or endangered species. The Northern Rocky Mountain population area includes portions of northern Idaho, western Montana, and northwestern Wyoming. Snowtrack surveys have documented fishers in the greater Yellowstone area during the late 1990s but a track and hair survey in Yellowstone from 2001 to 2004 did not detect fisher (Murphy et al. 2006; USFWS 2010b). Although there have been no recent verified sightings, fishers likely exist at very low numbers within the greater Yellowstone area (USFWS 2010b). Within Yellowstone, fishers may be found primarily in the heavily forested eastern sector of the park, also preferred by lynx. OSV traffic is limited in this section of the park, and interactions between fisher and OSVs are likely very rare. Fishers appear to tolerate fairly high levels of human activity, and are thriving in suburban New England. Habitat availability is considered the most important factor to their survival (Bull et al. 2001). Impacts to fisher from OSVs use under the alternatives evaluated in detail in this draft plan/EIS would be short-term, negligible adverse. Therefore, potential impacts on fishers from the alternatives under consideration in this plan are not analyzed in further detail.

Martens are smaller and more common than fisher in the greater Yellowstone area. Like fishers, martens remain active throughout the year and are most commonly found in older stands of spruce-fir. They prey on mice and voles, switching to red squirrels and hares as the snow deepens. Martens use meadows, forest edges, and rock alpine areas, with young born in mid-March to April. Mother martens raise the young in dens, and move dens frequently. Availability of dens is important for survival of young (Clark et al. 1989; Ruggiero et al. 1994). Forest fragmentation as a result of logging is a threat to the greater Yellowstone area population of marten, and disturbance of natal dens could limit survival of young. Because OSV use in Yellowstone would be restricted to roads under the alternatives in this draft plan/EIS and are not present in the park during the sensitive marten denning season, impacts from OSVs on martens under the alternatives evaluated would be short-term, negligible adverse. Therefore, potential impacts on martens from the alternatives under consideration in this plan are not analyzed in further detail.

Long-tailed weasels are solitary and voracious hunters. Weasels often tunnel under the snow to hunt prey. Long-tailed weasels are an unprotected species and little is known about their status in the park. Neither the subnivian (the area in or under the snow layer) fauna hunted by weasels nor weasel habitat would be affected by OSV use under any of the alternatives in this draft plan/EIS. OSV use is limited to road corridors, which limits the exposure of weasels to OSVs. Impacts to this species from OSV use are expected to be at most, short-term and negligible, adverse. Therefore, potential impacts on weasels from the alternatives under consideration in this plan are not analyzed in further detail.

Moose

Moose depend on mature lodgepole pine forests for their winter range and were historically rare in Yellowstone during the early 1900s. A 1980 survey estimated park populations at less than 1,000. Moose numbers appear to be dropping and future population trends likely depend upon habitat availability and conditions, predation levels, and human activities (Tyers 1999).

Moose have massive bodies, low surface area, and long legs that are well adapted to cope with extreme cold and deep snow, and moose are able to winter in areas with deeper snow than elk. Moose move from low elevation willow stands to up to 8,500-foot stands of subalpine fir and Douglas fir in November, where they overwinter (Tyers 2003) and browse on fir, willows, and lodgepole pine. Moose overwinter locations within the greater Yellowstone area include Hermitage Point area, Buffalo valley, Willow Flat, and the Snake and Gros Ventre river corridors. Within Yellowstone, they are commonly seen in the park’s southwestern corner along the Bechler and Falls rivers, around Yellowstone Lake, in the Soda Butte Creek, Pelican Creek, Lewis River, and Gallatin River drainages, and in Willow Park between Norris and Mammoth. Winter use occurs along the northwest side of Yellowstone Lake and on a one-mile segment along Falls River to Cave Falls. OSV routes under the alternatives being considered in this draft plan/EIS run adjacent to the Lewis River from Lewis River Falls to the confluence with the Snake River, and in the Willow Park area from Mammoth to Norris. An OSV route under the alternatives being considered in this draft plan/EIS also crosses the lower reach of Pelican Creek. OSV encounters with moose would be expected to be quite rare: annual wildlife behavioral monitoring of current OSV use in the park has no recorded sightings of moose encounters with OSVs. However, sound from OSVs may cause disturbance to moose in the area and is addressed in the “Soundscapes” section of the “Affected Environment” and “Environmental Consequences” chapters. Due to the lack of documented encounters and the limited areas of potential interaction, all alternatives being considered in this draft plan/EIS would have, at most, short-term negligible adverse impacts on moose. Therefore, potential impacts on moose from the alternatives under consideration in this plan are not analyzed in further detail.

Bighorn Sheep

Populations of bighorn sheep in Yellowstone were nearly eradicated by 1900. Since then, population estimates of bighorn sheep have varied from a low of 134 in 1998 to a high of 487 in 1981. Current threats to the population include competition with other ungulates (elk, mule deer, and bison) especially during severe winters, disease, and drought. The isolation and low population numbers of the Yellowstone bighorn sheep herds also limit population growth and range expansion. The population high of 1981 was reduced by 60% following an outbreak of pink-eye (Meagher 1992). Yellowstone’s bighorn herds were slow to recover and, as of January 2010, aerial surveys indicated a population of 250 to 275 animals (NPS 2010c; Greater Yellowstone Science Learning Center 2010). Bighorn sheep in Yellowstone winter exclusively in the steep, rocky areas found in the northern section of the park, with the core of the herd centered in the vicinity of Mount Evert. Sheep avoid areas of human activity or development, but a 150-meter buffer from a disturbance may be sufficient in areas of low to moderate human use (Schoeneker et al. 2004). Any road use or human development that affects the migration of sheep from their lower elevation winter range to higher elevation summer range may negatively impact bighorn sheep herd populations (Legg 1998). Several areas of bighorn sheep winter range are closed to the public to minimize any adverse effects public use may have on these populations. Groomed winter OSV routes under the alternatives being considered in this draft plan/EIS do not currently cross bighorn sheep winter range, with the closest motorized route to the Mt. Evert vicinity being the plowed road from Mammoth Hot Springs to Tower. Therefore, disturbance is currently limited to any sounds that may travel into the winter range from OSVs, motorized vehicles, or on-foot winter travelers. Impacts to bighorn sheep under all alternatives considered in this draft plan/EIS would be short-term negligible adverse. Therefore, potential impacts on bighorn sheep from the alternatives under consideration in this plan are not analyzed in further detail.

Pronghorn, Mule Deer, and White-tailed Deer

Pronghorn in Yellowstone spend the winter in the area between the north entrance and Reese Creek, in a 30-km area just northwest of Gardiner, Montana (Blank and Stevens 2006). Both mule deer and white-tailed deer are found in the park during the summer but mule deer primarily winter outside of the park to the north of park boundaries. White-tailed deer are uncommon in the park and winter in Yellowstone’s northern range, which is intersected by a wheeled-vehicle motorized route and where OSVs are rare (Barmore 2003). Annual winter wildlife monitoring surveys have no recorded interactions between OSV users and ungulate species other than bison and elk. Because pronghorn, mule deer and white-tailed deer winter outside of the park or in areas that are not exposed to winter OSV use proposed under the alternatives considered in this draft plan/EIS, impacts under all of the alternatives considered would be long-term negligible adverse. Therefore, potential impacts on pronghorn, mule deer and white-tailed deer from the alternatives under consideration in this plan are not analyzed in further detail.

Raven

Ravens are common throughout the park and a flourishing population is found in Yellowstone. In the past ravens have approached humans and areas of human activity for food and learned how to access storage compartments under snowmobile seats to access food. After 2003, guiding requirements restricted any feeding and clients were instructed to store food in places inaccessible to ravens, eliminating the success of ravens at obtaining human-supplied food (Tabor 2006). As such, the effects of OSV use on ravens under any alternative are expected to be minimal under the alternatives considered in this draft plan/EIS.

Similar to coyotes, no effects are assumed under alternative 1. Alternatives 2, 3, 4, 5, and 7 require commercial guides for any motorized vehicles entering the park. This commercial guiding requirement removes the possibility for problem behaviors from ravens because trained guides would continue to instruct their clients regarding food storage and feeding. Therefore, alternatives 2, 3, 4, 5, and 7 would result in short-term negligible adverse effects on ravens.

Under alternative 6, up to 25% of snowmobiles would enter the park unguided or non-commercially guided, increasing the likelihood of visitor-wildlife interactions. Although attempts would be made to educate unguided visitors on proper wildlife interactions, this may not be as effective as commercial guides ensuring visitor compliance. Therefore, alternative 6 would be expected to have short-term negligible to minor adverse effects on ravens.

Ravens are widespread in the park and impacts would not be greater than short- and long-term minor adverse under all of the alternatives. Therefore, potential impacts on ravens from the alternatives under consideration in this plan are not analyzed in further detail.

Birds

Most bird species are not addressed further in this analysis because they are only in the park during the summer or their habits are not considered threatened by winter recreation; therefore impacts from OSV use would be short-term and would range from no impact to negligible adverse impacts for most species. This includes peregrine falcons (*Falco peregrinus*), a species of special concern that was removed from the endangered species list in 1999. Peregrines' seasonal occurrence precludes them from being affected by winter recreation. Other raptor species in Yellowstone are not monitored as intensively as osprey, bald eagle, and peregrine falcon, mostly because they are common in the park and/or the NPS capability to inventory and monitor them is limited. Casual observations by bird monitors of common raptors such as golden eagles indicate that their population is stable. A USFWS golden eagle monitoring flight over the park in summer 2009 observed no golden eagles. These observations probably indicate that golden eagle density in the park is low (Baril et al. 2010). Annual winter wildlife monitoring reports observed very few golden eagle and OSV interactions. Out of about 5 to 8 observations from winter 2007 to 2009, the majority of observed golden eagle behavioral responses consisted of look-resume or no visible response, indicating few active movement responses by golden eagles (McClure et al. 2009; McClure et al. 2008; Davis et al. 2007). In the absence of any data indicating population decline, strong behavioral response, or displacement of golden eagles due to OSV use in the park, impacts to golden eagles from OSVs under the alternatives considered in this draft plan/EIS are predicted to be short-term negligible to minor adverse under the action alternatives (alternatives 2, 3, 4, 5, 6, and 7). The short-term minor adverse impacts expected under alternative 3 would be due to the higher amount of OSV use and impacts under alternative 6 would be due to the allowance for non-commerically guided/unguided use. Under the no-action alternative (alternative 1), no affects would be assumed from the limited administrative use that would occur. Therefore, potential impacts on other bird species (including peregrine falcons, osprey, and golden eagles) from the alternatives under consideration in this plan are not analyzed in further detail.

Subnivian Fauna

Subnivian fauna are small mammals that live under snow during winter, including shrews, voles, pocket gophers, and mice. They are active throughout the year, eat a variety of plant and animal foods, and generally occupy habitats on or below the ground. They are important prey species for a variety of birds and mammals. In general, subnivian fauna are abundant residents of the park and any potential loss of habitat caused by road grooming or plowing operations is compensated for by the vast amount of area in the park without roads. Also, because OSV travel is only allowed on hard road surfaces that are driven upon during non-winter months, no impacts to subnivian species or their habitat are likely. Research in other areas indicates that subnivian pits and burrows have been found currently under roads groomed for OSV use and in snowmobile play areas (Wildlife Resource Consultants 2004). Because of this, impacts under all of the alternatives considered in this draft plan/EIS would be short-term negligible adverse. Therefore, potential impacts on subnivian fauna from the alternatives under consideration in this plan are not analyzed in further detail.

Reptiles, Amphibians, Fish, and Invertebrates

Reptiles found in the park include the bull snake, prairie rattlesnake, and the sagebrush lizard. Semi-aquatic species include the wandering garter snake, valley garter snake, and rubber boa. Amphibians in the park include the Columbia spotted frog, boreal chorus frog, blotched tiger salamander, and the bullfrog. The boreal toad (*Bufo boreas boreas*) and the northern leopard frog (*Rana pipiens*), are amphibian species of special concern. The northern leopard frog was historically documented to breed in the park, but currently is very scarce (Koch and Peterson 1995); the boreal toad has declined in population. These two species use many aquatic habitats, including ponds, lakes, and other wetlands.

Fish are an important part of the wildlife population in the park, linking terrestrial and aquatic environments, and supplying an important food source for bald eagles and other wildlife. Over 20 species of fish are found in the park, including non-native species, trout, and salmonids. Special concern fish species include arctic grayling (*Thymus articus*), the snake river cutthroat (*Oncoryhynchus clarki bouvieri*), the westslope cutthroat trout (*Oncorhynchus Clarki lewisi*), and the leatherside chum (*Gila copei*). Aquatic invertebrates are abundant in the park, because of the wide variety of habitats including thermally influenced wetlands. About 170 species have been collected and identified.

OSVs and winter recreation would have either no impact or no more than short- and long-term negligible adverse impacts on reptiles, amphibians, fish, or invertebrates under the alternatives considered in this draft plan/EIS. Reptiles and amphibians are inactive or hibernate during the winter and are therefore not exposed to the impacts of OSV use; no impacts would be expected. OSV use would not directly impact fish or aquatic life. Air pollution from OSV engines, subsequent deposition of toxins in the snowpack, and indirect negative impacts on aquatic species from snowmelt was once a concern, but new BAT requirements have reduced emissions and minimized potential impacts. As noted under the water quality dismissal (below), although there is a clear relationship between OSV use and pollutant deposition in the snowpack, monitoring has shown quantities of OSV-related pollution in snowmelt that are in the range of background or near-background levels and would have no measurable effect (Arnold and Koel 2006). Impacts to reptiles, amphibians, fish, or invertebrates would be non-existent (alternative 1) or short- and long-term negligible adverse (alternatives 2, 3, 4, 5, 6, and 7) under the alternatives considered in this draft plan/EIS. Therefore, potential impacts on reptiles, amphibians, fish, or invertebrates from the alternatives under consideration in this plan are not analyzed in further detail.

WETLANDS AND FLOODPLAINS

Executive Order 11988 and NPS policy require that impacts on floodplains be considered in NPS undertakings. The intent of the order and guidelines is to provide for human safety and protect floodplain functions by preventing development in 100-year floodplains. Floodplains for Yellowstone are well defined. No actions proposed in this draft plan/EIS would occur in or encroach upon floodplains and all actions would occur during the winter months when there is little concern for flooding.

Similarly, Executive Order 11990 and NPS policy require that impacts on wetlands be considered in NPS undertakings. The intent of the order and guidelines is to protect the high resource values found in wetlands by requiring that evaluation of alternatives occur and mitigation be designed prior to development in wetlands. No actions proposed in this draft plan/EIS would occur in or encroach upon wetlands and all actions would occur during the winter months on paved roads that are open for wheeled vehicle travel in the summer. Therefore, potential impacts on wetlands and floodplains from the alternatives under consideration in this plan are not analyzed in further detail.

ECOLOGICALLY CRITICAL AREAS

Rare or Unusual Vegetation

Pursuant to Section 4.4 of the NPS *Management Policies 2006* (NPS 2006a), vegetation will be maintained as a part of the natural ecosystem of the park. Most documented vegetation impacts from OSV, specifically snowmobiles, occur when they are driven away from established roads and trails. In the park, OSV activities are limited to paved roads and along road margins where motorized use is allowed throughout the year. Because little or no vegetation exists on or immediately adjacent to the established OSV routes (which would be the same as the routes under the alternatives considered in this draft plan/EIS) during the winter, winter use including OSV use is not likely to impact vegetation. Therefore, potential impacts on rare or unusual vegetation from the alternatives under consideration in this plan are not analyzed in further detail.

Unique Ecosystems, Biosphere Reserve, and World Heritage Sites

Section 4.3 of the NPS *Management Policies 2006* (NPS 2006a) states that the NPS recognizes that special designations apply to parts or all of some parks to highlight the additional management considerations that those designated areas warrant. Yellowstone National Park is a designated Biosphere Reserve as well as a designated World Heritage Site.

Because no changes would be made to the designation of, or contributing attributes to the Biosphere Reserve or World Heritage Site from the alternatives considered in this draft plan/EIS, potential impacts on these resources are not analyzed in further detail.

Wilderness

Yellowstone contains proposed wilderness. Section 6 of NPS *Management Policies 2006* (NPS 2006a) states, “All NPS lands will be evaluated for their eligibility for inclusion within the national wilderness preservation system. For those lands that possess wilderness characteristics, no action that would diminish their wilderness eligibility will be taken until after Congress and the President have taken final action. Wilderness considerations will be integrated into all planning documents to guide the preservation, management, and use of the park’s wilderness area and ensure that wilderness is unimpaired for future use and enjoyment as wilderness.”

Impacts of OSV use under the alternatives considered in this draft plan/EIS to wilderness may include impacts to the soundscape. Requirements to use BAT in Yellowstone limit sound levels per snowmobile to 73 dBA or lower (NPS 2009a), but these requirements do not consider frequency. Sounds in the low frequency range (below 250 hertz (Hz)) generally travel farther than higher frequency sounds. When low frequencies are combined with specific sound pressures (dBA), tonal peaks occur. Tonal peaks produce long-traveling, loud sounds and are common to certain models of snowmobiles and snowcoaches (Menge and Ernenwein 2002; Hastings et al. 2008). These low frequency, tonal peaks are likely the parts of OSV sounds commonly heard at backcountry sites, including wilderness within the park, far from travel corridors. These potential impacts to the proposed wilderness in the park are described in this draft plan/EIS under the “Soundscapes” section. Other attributes related to wilderness that could be impacted are also discussed under other sections of this draft plan/EIS such as “Visitor Use and Experience” and “Air Quality.” Winter use would not impact proposed wilderness areas in other ways because it would occur on established paved roads outside of any proposed Wilderness. Therefore, potential impacts on wilderness (as a standalone impact topic) from the alternatives under consideration in this plan are not analyzed in further detail.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act was passed in October of 1968 (Public Law 90-542, as amended 16 USC 1271-1287). The goal of the wild and scenic river designation is to preserve the character of the river. Developments not damaging to the resources of a designated river or curtailing its free flow are usually allowed. Yellowstone has one designated wild and scenic river, the Snake River Headwaters, which includes portions of both the Lewis and Snake rivers (National Wild and Scenic Rivers System 2010). However, the implementation of a winter use plan, including OSV use, would not have an effect on the rivers because OSV use under the alternatives considered in this draft plan/EIS would be confined to a paved, main park entrance road that parallels a portion of the scenic Lewis River. As discussed above, ongoing monitoring has found that pollutants in the melting snowpack are not impacting the water quality in these rivers. Therefore, potential impacts on wild and scenic rivers from the alternatives under consideration in this plan are not analyzed in further detail.

Important Scientific, Archeological, and Other Cultural Resources, Including Historic Properties Listed or Eligible for the National Register of Historic Places

Archeological Resources

Archeological resources are the remains of past human activity and records documenting the scientific analysis of these remains. There are no known archeological resources in areas where winter use activities under consideration in this plan would occur. Therefore, potential impacts on archeological resources from the alternatives under consideration in this plan are not analyzed in further detail.

Cultural Landscapes

The NPS defines cultural landscapes as geographic areas associated with historic events, activities, or people that reflect that park's history, development patterns, and the relationship between people and the park. Cultural landscapes at the park include Fort Yellowstone, the area of Old Faithful, and areas significant to Native American cultures, such as sacred sites. None of the actions under consideration in this plan are expected to affect the characteristics of these areas that contribute to their designation as cultural landscapes. Therefore, potential impacts on cultural landscapes from the alternatives under consideration in this plan are not analyzed in further detail.

Prehistoric/Historic Structures and Districts

According to Director's Order 28: Cultural Resource Management, structures are defined as material assemblies that extend the limits of human capability. In plain language, this means a constructed work, usually immovable by nature or design, consciously created to serve some human activity. Examples are buildings, monuments, dams, roads, railroad tracks, canals, millraces, bridges, tunnels, locomotives, nautical vessels, stockades, forts and associated earthworks, Indian mounds, ruins, fences, and outdoor sculpture. In Yellowstone National Park, 17 sites are listed on the National Register of Historic Places. While some of these sites may be in proximity to winter use activities, these activities would remain on established routes that would not impact the integrity of these structures. Therefore, potential impacts on prehistoric/historic structures and districts from the alternatives under consideration in this plan are not analyzed in further detail.

Ethnographic Resources

An ethnographic resource is a resource under NPS stewardship that is of cultural significance to peoples traditionally associated with it. In other words, the resource is "closely linked [the peoples'] own sense of purpose, existence as a community, and development as ethnically [and occupationally] distinctive peoples." In 2000, researchers identified approximately 300 ethnographic resources and 26 tribes associated with the park (NPS 2005a). The resources include animals, plants, geology, and archeology sites. As part of government-to-government relationships, consultation with affiliated tribes has occurred and will occur on winter use and other planning and management topics. Through this past consultation it was determined that any potential impacts to these resources would be addressed under other impact topics in this document, such as wildlife and wildlife habitat. Furthermore, the majority of these resources would not be in the areas where winter use activities considered in this plan would occur and would not be disturbed; therefore, potential impacts on ethnographic resources from the alternatives under consideration in this plan are not analyzed in further detail.

Museum Collections

Yellowstone's museum collections storage area is in the Heritage and Research Center in Gardiner, Montana. These collections are not in areas where any of the winter use activities considered in this plan would occur, including OSV use, and would not be affected by the implementation of any of the alternatives considered in this draft plan/EIS. Therefore, potential impacts on museum collections from the alternatives under consideration in this plan are not analyzed in further detail.

Paleontological Resources

Paleontological resources (fossils and their associated data) are a major source of evidence of past life. They are the basis for our understanding of the history of life on Earth, and are an integral part of our planet's biodiversity. No paleontological resources would be impacted by winter use activities considered in this plan, therefore, potential impacts on paleontological resources from the alternatives under consideration in this plan are not analyzed in further detail.

PRIME AND UNIQUE AGRICULTURAL LANDS

According to the Farmland Protection Policy Act (FPPA), "farmland" includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban built-up land. Based on the FPPA's definition, there are no prime or unique farmlands within the park. Therefore, potential impacts on prime and unique agricultural lands from the alternatives under consideration in this plan are not analyzed in further detail.

POSSIBLE CONFLICTS BETWEEN THE PROPOSED ACTION AND LAND USE PLANS, POLICIES, OR CONTROLS FOR THE AREA (INCLUDING LOCAL, STATE, OR INDIAN TRIBE)

As noted earlier in this chapter, Yellowstone has engaged in extensive consultation with federal, state, and local agencies, as well as tribal interests, throughout the history of winter use planning. Part of consultation is the inclusion of cooperating agencies for this draft plan/EIS. As further explained in the "Consultation and Coordination" chapter, in January 2010 the NPS sent invitations to federal and state agencies involved in past winter use planning efforts, inviting them to become cooperating agencies for this winter use planning process. The following entities were invited to be cooperating agencies for this effort: the USFWS; U.S. Environmental Protection Agency (EPA); State of Idaho; State of Montana; State of Wyoming; Fremont County, Idaho; Gallatin County, Montana; Park County, Montana; Park County, Wyoming; and Teton County, Wyoming. The U.S. Forest Service (USFS) and USFWS declined the invitation to be cooperating agencies, but the other agencies invited signed Memorandums of Understanding to become cooperating agencies for this effort. In addition, each of these agencies was asked to provide information relevant to this planning process, including any conflicts with their planning efforts, and during this process no conflicts were identified.

This consultation has ensured that the plans and policies of these organizations are taken into account during the planning process, and therefore would have no measurable effect on the land use plans, policies, or controls of local or state agencies or Indian tribes from the alternatives considered in this draft plan/EIS. Therefore, potential impacts on the land use plans, policies, or controls of local or state agencies or Indian tribes from the alternatives under consideration in this plan are not analyzed in further detail.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Pursuant to NPS *Management Policies 2006* (NPS 2006a), "The National Park Service will conduct its activities in ways that use energy wisely and economically. Park resources and values will not be degraded to provide energy for NPS purposes. The Service will adhere to all federal policies governing energy and water efficiency, renewable resources, use of alternative fuels, and federal fleet goals as established in the Energy Policy Act of 1992." This draft plan/EIS considers the issue of energy resources and sustainability in chapters 3 and 4 under the Park Winter Operations and Management section; therefore, the impacts of such issues were not carried forward as a separate impact topic.

NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL

Although climatologists are unsure about the long-term results of global climate change, it is clear that the planet is experiencing a warming trend that affects ocean currents, sea levels, polar sea ice, and global weather patterns. These changes will likely affect winter precipitation patterns and amounts in the park; however, it would be speculative to predict localized changes in snow water equivalency or average winter temperatures, in part because many variables are not fully understood and there may be variables not currently defined. Therefore, the analysis in this document is based on past and current weather patterns and the effects of future climate changes are not discussed further.

Yellowstone is actively involved in environmental stewardship, particularly in the last decade with implementation of initiatives such as the Greening of Yellowstone. The greening initiative includes recycling, waste reduction, energy reduction, building a compost facility for park wastes, Leadership in Energy and Environmental Design building certification, and the use of hybrid vehicles and bio-fuels in summer and winter. The park continues its advances in environmental education and action, including steps to reduce activities that contribute to climate change. In addition, the park has investigated historic snowpack trends to explore the role of winter use in climate change and conservation potential by tracking both snowmelt as well as temperatures throughout the winter season (Farnes and Hansen 2005).

Some of the activities associated with winter use, including OSVs, would result in fossil fuel consumption. OSV use at the park would result in fossil fuel consumption and release of greenhouse gas (GHG) emissions. The NPS, USFS, and USFWS have inventoried the amount of GHG emissions they produce in the greater Yellowstone area ecosystem. The inventory at the park revealed the following:

- Electricity use is responsible for more than 60 percent of the GHG emissions because of the emissions created in producing the electricity (coal mines, power plants, etc.).
- Heating and cooling park buildings contributes 27 percent to GHG emissions.
- Cars, trucks, heavy equipment, and other vehicles directly emit almost 13 percent of the GHGs at Yellowstone.

As a result of completing the comprehensive GHG emissions inventory, the agencies are developing an action plan to reduce GHG emissions in all their operations across the entire ecosystem (NPS 2010c).

Based on this inventory, mobile sources make the up smallest amount of GHG emissions in the area, with winter use occurring at such a low volume that it is responsible for only a small amount of the 13 percent.

In addition, all alternatives considered in this draft plan/EIS require BAT for all OSVs, which would also contribute to keeping GHG emissions a small overall contributor. Based on the BAT requirement, GHG emissions associated with this draft plan/EIS would be expected to be negligible in comparison to local, regional, and national GHG emissions. Therefore, the impacts of OSV management and use activities contributing to climate change through GHG emissions under the alternatives considered in this plan was dismissed from further analysis.

INDIAN TRUST RESOURCES AND SACRED SITES

Indian trust resources are land, water, minerals, timber, or other natural resources held in trust by the United States for the benefit of an Indian tribe or individual tribal member. In government-to-government consultations with Native American tribes on planning and management issues, including winter use, a variety of park resources have been identified as being significant to many tribes. The entire range of alternatives evaluated in this draft plan/EIS, with their prescribed mitigations, would not create adverse effects on sacred sites or Indian trust resources. Scoping for this draft plan/EIS did not identify any new issues relative to these resources. The NPS has and will continue to consult with tribes on winter use and other planning and management topics and to manage the park for the benefit of all citizens of the United States. Therefore, potential impacts on Indian trust resources and sacred sites from the alternatives under consideration in this plan are not analyzed in further detail.

RELATED LAWS, POLICIES, PLANS, AND CONSTRAINTS

GUIDING LAWS AND POLICIES

The following laws, policies, and plans by the NPS, state governments, or agencies with neighboring land or relevant management authority are described in this section to show the framework and constraints this draft plan/EIS will need to operate under and the goals and policies that will be considered. These related laws, policies, plans, and constraints will guide the development and implementation of this winter use plan.

NPS Organic Act

By enacting the NPS Organic Act of 1916, Congress directed the U.S. Department of the Interior and NPS to manage units of the national park system “to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations” (16 USC 1). The 1978 Redwood Amendment reiterates this mandate by stating that the NPS must conduct its actions in a manner that will ensure no “derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress” (16 USC 1 a-1). Congress intended the language of the 1978 Amendment (which was included in language expanding Redwood National Park) to reiterate the provisions of the Organic Act, not to create a substantively different management standard. The House committee report described the 1978 Amendment as a “declaration by Congress” that the promotion and regulation of the national park system is to be consistent with the Organic Act (NPS 2006a). The Senate committee report stated that under the 1978 Amendment, “The Secretary has an absolute duty, which is not to be compromised, to fulfill the mandate of the 1916 Act to take whatever actions and seek whatever relief as will safeguard the units of the national park system” (NPS 2006a). Although the Organic Act and the 1978 Amendment use different wording (“unimpaired” and “derogation”) to describe what the NPS must avoid, both acts define a single standard for the management of the national park system—not two different standards. For simplicity, NPS *Management Policies 2006* uses “impairment,” not both statutory phrases, to refer to that single standard.

Despite these mandates, the Organic Act and its amendments afford the NPS latitude when making resource decisions to allow appropriate visitor use while preserving resources. Because conservation remains predominant, the NPS seeks to avoid or to minimize adverse impacts on park resources and values. Yet, the NPS has discretion to allow negative impacts when necessary (NPS 2006a sec. 1.4.3, 10). Although some actions and activities cause impacts, the NPS cannot allow an adverse impact that constitutes resource impairment (NPS 2006a sec. 1.4.3, 10). In the administration of authorized uses, park managers have the discretionary authority to allow and manage the use, provided that the use will not cause impairment or unacceptable impacts. The 1978 Amendment prohibits actions that impair park resources unless a law directly and specifically allows for the action (16 USC 1a-1) (NPS *Management Policies 2006*, Section 1.4.3.1).

In the administration of authorized uses, park managers have the discretionary authority to allow and manage the use, provided that the use will not cause impairment or unacceptable impacts. The 1978 Amendment prohibits actions that impair park resources unless a law directly and specifically allows for the action (16 USC 1a-1) (NPS Management Policies 2006, Section 1.4.3.1).

Because park units vary based on their enabling legislation, natural resources, cultural resources, and missions, management activities appropriate for each unit, and for areas in each unit, vary as well.

Yellowstone National Park Organic Act USC, Title 16, sec. 22 (16 USC 22)

Congress established Yellowstone National Park to “dedicate and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people; … for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition” (U.S. Congress 1872). The Yellowstone National Park Protection Act, signed March 1, 1872, established the park and set forth its mission. The Organic Act (1916) built upon that landmark law to form the NPS.

National Parks Omnibus Management Act of 1998

The National Parks Omnibus Management Act of 1998 (16 USC 5901 et seq.) is fundamental to NPS park management decisions. This act provides direction for articulating and connecting the ultimate resource management decision to the analysis of impacts, using appropriate technical and scientific information.

NPS *Management Policies 2006*

NPS *Management Policies 2006* address management of snowmobiles in Section 8.2.3.2, Snowmobiles. This section states (NPS 2006a):

> Snowmobile use is a form of off-road vehicle use governed by Executive Order 11644 (Use of Off-road Vehicles on Public Lands, as amended by Executive Order 11989), and in Alaska also by provisions of the Alaska National Interest Lands Conservation Act (16 USC 3121 and 3170). Implementing regulations are published at 36 CFR 2.18, 36 CFR Part 13, and 43 CFR Part 36. Outside Alaska, routes and areas may be designated for snowmobile and oversnow vehicle use only by special regulation after it has first been determined through park planning to be an appropriate use that will meet the requirements of 36 CFR 2.18 and not otherwise result in unacceptable impacts. Such designations can occur only on routes and water surfaces that are used by motor vehicles

> or motorboats during other seasons. In Alaska, the Alaska National Interest Lands Conservation Act provides additional authorities and requirements governing snowmobile use.
>
> NPS administrative use of snowmobiles will be limited to what is necessary (1) to manage public use of snowmobile or oversnow vehicles routes and areas; (2) to conduct emergency operations; and (3) to accomplish essential maintenance, construction, and resource protection activities that cannot be accomplished reasonably by other means.

Management policies relating to resource protection also were considered in developing this draft plan/EIS. For example, NPS *Management Policies 2006* instructs park units to maintain, as parts of the natural ecosystems of parks, all plants and animals native to the park ecosystems, in part by "minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them" (NPS 2006a, sec. 4.4.1).

Architectural Barriers Act of 1968

The Architectural Barriers Act requires access to facilities designed, built, altered, or leased with federal funds. The Access Board, created under this act, develops and maintains accessibility guidelines under this law. These guidelines serve as the basis for the standards used to enforce the law. Following this act, other acts to promote accessibility were enacted and include the Americans with Disabilities Act of 1990 (which have been updated in 2010, with an effective date for implementation of March 15, 2012), the Rehabilitation Act of 1973, the Uniform Federal Accessibility Standards of 1984, and the Guidelines for Outdoor Developed Areas of 1999.

National Environmental Policy Act of 1969, as Amended

NEPA is implemented through regulations of the CEQ (40 CFR 1500–1508). The NPS has in turn adopted procedures to comply with NEPA and the CEQ regulations, including the Department of the Interior NEPA Regulations (43 CFR Part 46), Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making, and its accompanying handbook (NPS 2001). Section 102 (2)(C) of NEPA requires that an EIS be prepared for proposed major federal actions that may significantly affect the quality of the human environment.

NPS Director's Order 77: Natural Resource Protection

Director's Order 77 addresses natural resource protection, with specific guidance provided in Reference Manual 77: Natural Resource Management. Reference Manual 77 offers comprehensive guidance to NPS employees responsible for managing, conserving, and protecting the natural resources found in national park system units. The manual serves as the primary guidance on natural resource management in units of the national park system. Reference Manual chapters that are particularly relevant to this draft plan/EIS include endangered, threatened, and rare species management; native animal management; and air resources management.

Wilderness Act of 1964 and Director's Order 41: Wilderness Preservation and Management (1999)

The Wilderness Act states, "In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." Despite the great similarity between the NPS Organic Act and the Wilderness Act, Congress applied the Wilderness Act to NPS to strengthen its protective capabilities.

Under the Wilderness Act, the park must apply the 'minimum requirement' concept to all management activities that affect the wilderness resource. This concept is intended to minimize impacts on wilderness values and resources. Managers may authorize (using a documented process) the generally prohibited activities or uses listed in Section 4(c) of the Wilderness Act if deemed necessary to meet the minimum requirements for the administration of the area as wilderness and where those methods are determined to be the 'minimum tool' for the project.

The purpose of Director's Order 41 is to provide accountability, consistency, and continuity to the NPS wilderness management program, and to otherwise guide servicewide efforts in meeting the letter and spirit of the 1964 Wilderness Act.

Endangered Species Act of 1973, as Amended

The 1973 ESA provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. Section 7 of this act requires all federal agencies to consult with the Secretary of the Interior on all projects and proposals with the potential to impact federally endangered or threatened plants and animals. It also requires federal agencies to use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Federal agencies are also responsible for ensuring that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat. Section 9 of the act makes it unlawful for a person to "take" a listed animal without a permit. The term "take" is defined in the act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Through regulations, the term "harm" is defined as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." Listed plants are not protected from take; however, it is illegal to collect or maliciously harm them on federal land. The act also imposes civil and criminal penalties for violations of any provisions of the act.

Migratory Bird Treaty Act of 1918 and Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds

Migratory birds are of great ecological and economic value to this country and to other countries. They contribute to biological diversity and bring tremendous enjoyment to millions of people who study, watch, feed, or hunt these birds throughout the United States and other countries. The United States has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds. These migratory bird conventions impose substantive obligations on the United States for the conservation of migratory birds and their habitats, and through the Migratory Bird Treaty Act (MBTA), the United States has implemented these migratory bird conventions with respect to the United States. Executive Order 13186 directs executive departments and agencies to take certain actions to further implement the MBTA. The MBTA implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under this Act, it is prohibited, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention…for the protection of migratory birds…or any part, nest, or egg of any such bird" (16 USC 703). Subject to limitations in the Act, the Secretary of the Interior may adopt regulations determining the extent to which, if at all, hunting, taking, capturing, killing, possessing, selling, purchasing, shipping, transporting or exporting of any migratory bird, part, nest or egg will be allowed, having regard for temperature zones, distribution, abundance, economic value, breeding habits, and migratory flight patterns. Pursuant to Executive Order 13186, 66 Fed. Reg. 3853 (January 2001), entitled "Responsibilities of Federal Agencies to Protect Migratory Birds," the NPS and USFWS further signed a Memorandum of Understanding in April 2010 that outlines a collaborative and proactive approach to promote the conservation of migratory birds (http://www.nature.nps.gov/biology/migratoryspecies/Documents/MBMOUNPSSigned041210.pdf).

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC 668-668d), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle … [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"

The NPS must address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, including planning projects, on minority populations and low-income populations.

RELATED PLANS, POLICIES AND ACTIONS FOR YELLOWSTONE NATIONAL PARK

Yellowstone National Park Master Plan (1974)

The Yellowstone National Park Master Plan addresses winter use by stating that "Yellowstone will be managed on a year-round use basis. There are two defined periods of heavy use, and the management and operation must be geared to such for maximum enjoyment of the resources by the visitor – May 1 through October 31 (summer) and December 1 through March 15 (winter)." It is also recognized that OSVs have been in use at the park since 1949 and that snowmobiles have been used for 45 of the park's 136 years. In addition, there can be spatially long distances between park attractions.

Yellowstone National Park Long-Range Interpretive Plan (2000)

The 2000 Long-Range Interpretive Plan (NPS 2000a) provides recommendations on programs, technologies, and methods to achieve goals for keeping the park meaningful, valued, and relevant to a diverse visitor population over the next 7 to 10 years. The plan discussed OSV issues at the time the plan was drafted (2000) referring to the 2000 Final Winter Use Plan for further information. Because other planning processes have occurred since this time, recommendations on winter use in the long-range interpretive plan may not be applicable to winter use management today.

Yellowstone National Park Strategic Plan

The Yellowstone National Park Strategic Plan (NPS 2005d) reexamined the park's fundamental mission (from the park's 1974 Master Plan) with a new long-term view of the results or outcomes needed to more effectively and efficiently accomplish the park's mission. The plan noted that of the 466 miles of road, approximately 184 are groomed for OSV use during the winter.

Construction Projects throughout the Park

Numerous past, ongoing, and planned construction projects are occurring throughout the park. These projects have added to or changed the infrastructure operating in the park during the winter season, impacting both how the park operates and how the visitor experiences the park during this time. Projects have included the following:

- **Reconstruction of the East Entrance Road at Sylvan Pass, Yellowstone National Park (2010)**. This project was completed in 2010 to reconstruct the segment of road at the pass to park road standards. This project also generally moved the road away from avalanche paths along the staff's route to the gun mount and improved safety for avalanche control operations
- **Construction of West Entrance, Yellowstone National Park (2008)**. Yellowstone recently completed a new west entrance immediately east of the existing facility. The west entrance facility could affect employee and visitor health and safety due to the inclusion of ventilation systems in the booths that reduce staff exposure to air pollutants.

Winter Activities in Yellowstone

A wide range of activities exist in Yellowstone in the winter that includes photography, wildlife viewing, walking, skiing, and snowshoeing. Yellowstone has 35 miles of groomed trails, or for the adventurous, many miles of backcountry trails available for skiing or snowshoeing. A park concessioner operates lodging accommodations at Mammoth Hot Springs and Old Faithful and concessioners provide other services, including evening programs, snowmobile and snowcoach tours, guided ski and snowshoe tours, wildlife tours, ski shop and repair center, massage therapy, hot tub rentals, and ice skating rinks. In addition a yurt camp is available at Canyon, which is operated by one of the park's snowcoach outfitters. The NPS also provides ranger-led winter programs that offer insight into the history, culture, and geography of Yellowstone National Park. Winter programs begin when the park opens for the winter season December 15 and end on March 15.

Implementation of the Interagency Bison Management Plan

Since the mid-1980s, increasing numbers of bison have moved to low-elevation winter ranges outside the northern and western parts of Yellowstone in response to accumulating snow pack. Such bison movement led to an enduring series of societal conflicts among various public and management entities regarding bison abundance and the potential transmission of brucellosis to domestic cattle with widespread economic repercussions. As a result, the federal government and the state of Montana agreed to an Interagency Bison Management Plan (IBMP) that established guidelines for managing the risk of brucellosis transmission from bison to cattle by implementing hazing, testing for disease exposure, shipments of bison to domestic slaughter facilities, hunting (outside Yellowstone National Park), vaccination, and other actions near the park boundary. This plan also identified the need to conserve bison and established conservation zones encompassing more than 250,000 acres of the northern two-thirds of the park and portions of the adjacent Gallatin National Forest (IBMP 2010).

The Record of Decision for the IBMP was signed in December 2000 to coordinate bison management between the State of Montana and Yellowstone National Park. Five agencies signed or adopted this agreement to work cooperatively within an adaptive management framework to implement the IBMP—the U.S. Department of Agriculture's Animal and Plant Health Inspection Service and USFS; the Department of the Interior's NPS; and the State of Montana's Department of Fish, Wildlife, and Parks and Department of Livestock. The Confederated Salish and Kootenai Tribes, InterTribal Buffalo Council, and Nez Perce Tribe became IBMP agencies in 2009. The plan seeks to maintain a wild, free-ranging bison population, reduce the risk of brucellosis transmission from bison to cattle, manage bison that leave the park and enter the state of Montana, and maintain Montana's brucellosis-free status for domestic livestock. Public scoping raised concerns that ORV traffic and the subsequent grooming of roads have the possibility of increasing bison movement within and outside the park, which would trigger bison management under the IBMP.

Remote Vaccine Plan for Bison

The NPS is considering the remote delivery of a vaccine to free-ranging bison in the park for the contagious disease brucellosis, which is caused by the non-native bacteria Brucella abortus. Remote delivery is distinguished from hand (syringe) delivery that currently occurs in capture pens near the park boundary because it would not involve capture and handling of bison. The most logical strategy for remote delivery of vaccine at this time is using a compressed air-powered rifle that delivers an absorbable bullet with a vaccine payload that is freeze dried or photo-polymerized. The purpose for taking action is directed by a 2000 Record of Decision for the IBMP regarding the release of bison outside the park that are untested for exposure to brucellosis. The goal of a remote delivery vaccination program would be to deliver a low risk, effective vaccine to eligible bison inside the park to (1) decrease the probability of individual bison shedding Brucella abortus, (2) lower the brucellosis infection rate of Yellowstone bison, and (3) reduce the risk of transmission to cattle outside the park. Public scoping raised concerns that bison would leave the park as a result of winter use and be removed due to concerns of brucellosis.

OTHER FEDERAL AGENCY PLANS, POLICIES, AND ACTIONS

In addition to the laws and policies above, other federal planning documents exist that directly or indirectly relate to winter use at the park, and were taken into consideration during the development of this draft plan/EIS.

The Northern Rockies Lynx Management Direction Final Environmental Impact Statement and Amendments

The Northern Rockies Lynx Management Direction Final EIS and Amendments were developed to conserve the Northern Rockies lynx (*Lynx canadensis*) species, listed as threatened on the endangered species list. These changes would keep recreation at or near current levels in occupied lynx habitats on USFS lands to ensure species survival. Lynx thrive in areas with deep soft snow, where predators are excluded during the winter months; however, the use of OSVs can cause the snow to become more compacted leaving the area more prone to predators and other competition to occupy the area. Regulating where OSV use can occur on other federally managed lands in the region would impact both recreational opportunities in the area (visitor use and experience) as well as habitat available for the lynx (wildlife and wildlife habitat).

Gallatin National Forest Travel Plan Revision

The Gallatin National Forest Travel Plan provides a comprehensive evaluation of how best to provide for road and recreational demands in conjunction with other resource uses and land stewardship needs. The plan examines 39 different wilderness areas within the National Forest and the suitability of these areas for travel. The plan reduced the number of permitted OSV useable and ride-able areas within the National Forest (from about 84% of the National Forest to about 53%) but increased the miles of marked and groomed trail, potentially affecting the availability of winter use recreation opportunities in the region, specifically OSV opportunities.

Consolidation of Checkerboard Lands on the Gallatin National Forest

In the last ten years, the Gallatin National Forest has negotiated several land exchanges that have consolidated some previously checkerboarded holdings. Although this has generally positive effects for most wildlife (because consolidated lands are less subject to development), it has the negative side effect of private land consolidation (especially in the Big Sky area), which has allowed more land subdivision and rural growth, with consequent effects on wildlife, air quality, socioeconomics, and visitor access and circulation.

Gardiner Basin and Cutler Meadows Restoration

This plan is for restoring federally owned sites in Gardiner Basin and Cutler Meadows. The sites were once tilled for agriculture and those tilled areas now support several invasive non-native species and fewer native plants than desired. The USFS and NPS are implementing long-term projects to restore native plants to these areas. These projects could affect wildlife, such as elk, bison, and pronghorn that use the Gardiner Basin for habitat.

Beartooth District of Custer National Forest Travel Management Plan

The Beartooth District of Custer National Forest Travel Management Plan was completed in 2008. The plan identifies a system of roads and trails to be used by public motorized traffic. The plan limits motorized travel to certain roads and trails, and includes restrictions on winter use. This plan allows for snowmobile use throughout the Beartooth District, except for within wilderness, research natural areas, and recommended wilderness areas. The extent and availability of snowmobile recreation in the region has the potential to impact visitor use and experience, as well as available habitat for wildlife.

Improving OSV Technologies

In 2002, the EPA promulgated nationwide regulations for snowmobile emissions. Those regulations are being implemented in three phases: model years 2006, 2010, and 2012. The NPS BAT requirements are more stringent than the 2012 EPA regulations. These EPA regulations are helping spur the development of improved snowmobile technology and reduced emissions nationwide. As the manufacturers develop technologies to meet the 2012 requirements, the NPS is seeing model year 2011 snowmobiles that produce emissions well below NPS BAT requirements. Similarly, EPA wheeled vehicle emission regulations are being implemented for light-heavy to medium-heavy duty trucks. Many snowcoaches are based on these vehicle classes. Although emission characteristics of a vehicle in a tracked, oversnow mode are not comparable to its performance on wheels, these technological changes should also result in lower emissions for snowcoaches.

OTHER STATE AND LOCAL PLANNING DOCUMENTS, POLICIES, ACTIONS

A Toolkit to Protect the Integrity of Greater Yellowstone Area Landscapes

The land area surrounding the park has experienced rapid population growth for the last twenty years. Such growth can lead to more demand for recreation (snowmobiling, cross-country skiing, and snowshoeing), more recreationists in wildlife habitat, and more resulting impacts on air quality, soundscapes, economics, and wildlife. In addition, development patterns hold great importance. Development patterns on private lands near public lands can have effects on wildlife, air quality, noise mitigation, water resources, and firefighting. In addition, private developments near public land can affect historic aspects, habitat, and ecosystems. The Greater Yellowstone Coordinating Committee developed “A Toolkit to Protect the Integrity of Greater Yellowstone Area Landscapes” in 2008 to provide information to agency staff on voluntary options. This toolkit comprises nine topics, all of which work to help restore the natural Yellowstone landscape. These nine topics include the current land status in the greater Yellowstone area, general discussion of land adjustment tools, guidance for public agency participation in local land use, case studies of successfully regional conservation efforts, greater Yellowstone area land trusts and conservation partners, conservation buyers in the greater Yellowstone area, sources of funding for land acquisition and easements, sources for land stewardship without land or easement purchase, and key strategies and research data. Population growth and an increase in recreational activities may lead to more OSV use within the greater Yellowstone area.

Reclamation of Historic Mines above Cooke City

This ongoing project will reclaim 10–20 mines in more than 1,500 acres in the New World Mining District, which is adjacent to the park. Specific projects include reclaiming high-elevation mining waste dumps and improving water quality at the headwaters of the Yellowstone and Stillwater rivers. A 10-year cleanup program reclaimed a dozen mines and waste dumps, and improved water quality in Fisher, Miller, Daisy, and Soda Butte creeks (GYC 2010). Reclamation of this area has protected the headwaters and the species that rely on the headwaters, such as trumpeter swans, and provided additional habitat and recreational opportunities in the area.

Reclamation of McLaren Mine Tailings

The McLaren Mine Tailings Site is near Cooke City, Montana, in a valley drained by Soda Butte Creek, which runs through the site and eventually through Yellowstone, approximately five miles downstream. Environmental studies conducted over the past 30 years have determined that the McLaren Mine Tailings Site is a significant source of acid mine drainage contributing to the poor water quality of Soda Butte Creek (MTDEQ 2010b). The project involves stabilization and dehydration of approximately 320,000 tons of mine tailings and upon completing stabilization and removal activities, reclaiming the site. Site reclamation work began in June 2010 and includes active tailings dewatering, operation of a water treatment system, lime stabilization of mine wastes, and the construction of an on-site repository (MTDEQ 2010b). Once reclaimed, the site will provide for additional wildlife habitat in the area year-round and improve the water quality in Soda Butte Creek, which is used by wildlife.

Rendezvous Ski Trail Development Plan

The USFS and trail managers are revising their trail plan, which would develop, improve, abandon, and/or maintain the cross-country ski trails there. This could affect socioeconomics and visitor access and circulation. Once implemented, this plan would contribute to adding additional non-motorized winter use activities near the West Entrance.

Reopening of the Sleeping Giant Ski Area

This ski area is approximately three miles from Yellowstone and within immediate proximity to the east entrance. The ski area was originally opened as the Red Star Camp for the 1936/1937 ski season and is one of the oldest ski areas in the United States. In 1938, it was renamed the Sleeping Giant Ski Area. It was closed in 2004 because of financial difficulties when inspectors determined the T-bar lift was unsafe and funds were not available to repair it. In 2007, Sleeping Giant Ski Area was purchased by a handful of Cody, Wyoming, residents and improvements were made, including the installation of a new chairlift. The ski area reopened during the 2009/2010 winter season (ColoradoSkiHistory.com 2010 and Sleeping Giant Ski Area 2010). The reopening and continued operation of this ski area contributes to the winter recreational opportunities in the area during the winter use season.

Oil and Gas Leasing

Oil or gas leasing activities take place in numerous areas relatively close to the park. The Montana Department of Natural Resources & Conservation, Trust Land Management Division, Mineral Management Bureau maintains information of oil and gas leasing activity in Montana. The Fiscal Year 2010 Annual Report released by this agency reported no oil or gas production in those counties bordering the park (Gallatin and Park counties). Sweet Grass, Stillwater, and Carbon Counties—all northeast of Park County, which is adjacent to Yellowstone—reported the production of approximately 851 barrels of oil and 6,716 (MCFs or 1,000 cubic feet) of gas in 2010 (State of Montana, Department of Natural Resources and Conservation, Trust Management Division 2010). In Wyoming, gas and some oil production occurs in the Over Thrust Belt Basin in Sublette, Lincoln, and Sweetwater counties. These counties are south of Teton County, well south of the park. The Bighorn Basin, east of the park, is in eastern Park County and in Hot Springs, Washakie, and Big Horn counties. In 2009, oil production in Park County totaled approximately 7.45 million barrels of oil and 11.17 million MCFs of gas (Wyoming Oil and Gas Conservation 2009). Other areas of high oil or gas leasing activities are located further east and southeast of the park. The State of Idaho, Department of Lands, reports that there are currently no producing wells or recorded production of oil and gas (State of Idaho, Department of Lands 2010). Oil and gas leasing operations in the area operate year-round and facility operations would result in impacts to regional air quality and socioeconomics.

Aircraft Overflights

Aircraft overflights (including commercial jets, research flights of low flying propeller planes, corporate and general aviation aircraft, and medical rescue helicopters) cause motorized sounds audible at levels from very quiet to levels that mask other sounds. Relative to snowmobile and snowcoach-related sounds, the duration of audible aircraft overflights is short. The 2005–2010 observational study found that in total, motorized sounds were audible 56% of the time. Aircraft accounted for 6.7% of the duration of motorized sounds (Burson 2010a). These overflights could affect soundscapes in the park during the winter use season, as well as in the region. At Fern Lake in Yellowstone’s backcountry (a location 8 miles from the road where no OSVs were audible), aircraft were audible six percent of the time between 8 a.m. and 4 p.m. during the winter use period (Burson 2007).

Alternatives

CHAPTER 2: ALTERNATIVES

The National Environmental Policy Act (NEPA) requires federal agencies to consider a range of alternatives and fully evaluate a range of reasonable alternatives that address the purpose of and need for the action. Alternatives under consideration must include a “no-action” alternative in accordance with Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14). Action alternatives may originate from the proponent agency, local government officials, or members of the public at public meetings or during the early stages of project development. Alternatives may also be developed in response to comments from coordinating or cooperating agencies.

Alternatives analyzed in this document were developed based on the results of internal and public scoping, and information from the Yellowstone Science Advisory Team, resource workshops, and cooperating agencies, as well as past planning efforts. These alternatives meet, to a large degree, the management objectives of the park, while also meeting the overall purpose of and need for proposed action. Because each of the identified action alternatives is responsive to the objectives, the alternatives are considered reasonable. Alternatives and actions that were considered but were not technically or economically feasible, did not meet the purpose of and need for the project, created unnecessary or excessive adverse impacts to resources, and/or conflicted with the overall management of the park or its resources were dismissed from further analysis.

The National Park Service (NPS) explored and evaluated six action alternatives and the no-action alternative (summarized in table 10 at the end of this chapter), as follows:

- **Alternative 1: No-Action—No Snowmobile/Snowcoach Use**. Under the no-action alternative, the 2009 interim rule for winter use, which allowed up to 318 snowmobiles and 78 snowcoaches per day, expired in March 2011. As of March 15, 2011, no public oversnow vehicle (OSV) use would be permitted in Yellowstone. Non-motorized access and wheeled vehicle access (northern road) into the park would continue to be permitted. The east entrance (Sylvan Pass) would be closed to use during the winter season.
- **Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits**. Under alternative 2, management of OSVs would allow for snowmobile and snowcoach use levels to continue at the current level of up to 318 snowmobiles and 78 snowcoaches per day. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation restrictions, and best available technology (BAT) requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches.
- **Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits**. Alternative 3 would allow for snowmobile and snowcoach use levels to increase to the levels set forth in the 2004 plan of up to 720 snowmobiles and 78 snowcoaches per day. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation restrictions, and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches.
- **Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles**. Alternative 4 would provide a wide range of visitor use and opportunities, managing for commercial wheeled-vehicle use (no private vehicles would be allowed), OSV use, and non-motorized use throughout the park during the winter use season. The roads from West Yellowstone and Mammoth Hot Springs to Old Faithful would be plowed for access to the park by up to 100 wheeled commercial multi-passenger vehicles (buses and vans). The south entrance would be groomed for use of up to 110 snowmobiles and 30 snowcoaches. The east entrance

(Sylvan Pass) would be closed to use during the winter season. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation restrictions, and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches.

- **Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only**. Under alternative 5, OSV access to the park would be via BAT snowcoach only. This could be accomplished by phasing out snowmobiles beginning in the 2014/2015 season when all snowcoaches must meet BAT requirements. Snowcoaches could replace snowmobiles within a five-year period (depending on coach user demand, or at the discretion of the park). Should snowcoach user demand not reach 120 snowcoaches, some level of snowmobile use would remain. Alternative 5 would initially provide for both snowmobile and snowcoach access under current use levels of up to 318 snowmobiles and 78 snowcoaches per day. After the 2014/2015 season, snowcoach numbers could increase up to 120 per day, with a corresponding decrease in snowmobile numbers during the phase-out period. In the event that snowmobile technology improves in the future, this alternative would allow an operator to replace BAT coaches with electric, hybrid, or low emission snowmobiles as long as the combined CO+HC+ NO_x emissions do not exceed 50 grams per mile (or the equivalent grams per kilowatt-hour) and the sound level is less than 70 dbA, when measured by current J192 test procedures.
- **Alternative 6: Implement Variable Management**. Alternative 6 would manage OSV and visitor use to increase the variety of winter experiences by creating times and places for higher and lower levels of use and opportunities for undisturbed skiing and snowshoeing. OSV use would have a seasonal limit of up to 32,000 snowmobiles and 4,600 snowcoaches, with a daily limit of up to 540 snowmobiles and 78 snowcoaches. Up to 25 percent of snowmobile permits would be for unguided or non-commercially guided use. Most of the OSV requirements under the 2009 interim rule would continue including hours of operation restrictions and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches. In addition, operators would have the potential to increase their daily limits if they include and use newer, and cleaner, technologies in their fleets.
- **Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors.** Alternative 7 proposes a variety of use levels, which would establish a maximum number of snowmobiles and snowcoaches permitted in the park for specific days throughout the winter season. Four different use levels for each OSV type would be implemented, the combination of which may vary by day. Snowmobile use would range from 110 to 330 per day and snowcoach use would range from 30 to 80 per day. The varying use levels would provide for high and low OSV use days, allowing for a variety of motorized and non- motorized visitor experiences throughout the winter season. All OSV requirements under the 2009 interim rule would continue including all OSV commercial guide requirements, hours of operation restrictions, and BAT requirements for snowmobiles. BAT requirements would be developed and implemented for snowcoaches. BAT requirements would be developed and implemented for snowcoaches as well as additional BAT for snowmobiles that address NO_x and require snowcoaches not to exceed 73 dBA when operating at or near full speed for the 2014/2015 winter season. All OSV would also be required to enter the park by 10:30 a.m. In addition, operators could have the potential to increase their daily limits if they include newer, cleaner, technologies in their fleets.

DEFINITIONS

The following definitions are used when describing the range of alternatives:

- **Commercial guide** means a person who operates as a snowmobile or snowcoach guide for a fee or compensation and is authorized to operate in the park under a concession contract or a commercial use authorization. In this section, "guide" also means "commercial guide."
- **Historic snowcoach** means a Bombardier snowcoach manufactured in 1983 or earlier. Any other snowcoach is considered a non-historic snowcoach.
- **Oversnow route** means that portion of the unplowed roadway located between the road shoulders and designated by snow poles or other poles, ropes, fencing, or signs erected to regulate oversnow activity. Oversnow routes include pullouts or parking areas that are groomed or marked similarly to roadways and are adjacent to designated oversnow routes. An oversnow route may also be distinguished by the interior boundaries of the berm created by the packing and grooming of the unplowed roadway. The only motorized vehicles permitted on oversnow routes are OSVs.
- **Oversnow vehicle** or OSV means a snowmobile, snowcoach, or other motorized vehicle that is intended for travel primarily on snow and has been authorized by the superintendent to operate in the park. An OSV that does not meet the definition of a snowcoach must comply with all requirements applicable to snowmobiles.
- **Snowcoach** means a self-propelled mass transit vehicle intended for travel on snow, having a curb weight of over 1,000 pounds (450 kilograms), driven by a track or tracks and steered by skis or tracks, and having a capacity of at least 8 passengers. A snowcoach has a maximum size of 102 inches wide, plus tracks (not to exceed 110 inches overall); a maximum length of 35 feet; and a gross vehicle weight rating not exceeding 25,000 pounds. A snowcoach may not be operated if the gross vehicle weight rating of the vehicle (including track systems) is exceeded. As of December 14, 2014, a snowcoach may not be operated if it exerts a ground-surface pressure (calculated by dividing the gross vehicle weight rating (including track weight)) by the number of square inches of track in contact with the snow surface) exceeding 4.5 pounds per square inch.
- **Snowmobile** means a self-propelled vehicle intended for travel solely on snow, with a curb weight of not more than 1,000 pounds (450 kg), driven by a track or tracks in contact with the snow, and which may be steered by a ski or skis in contact with the snow. All-terrain vehicles and utility-type vehicles are not snowmobiles, even if they have been adopted for use on snow with track and ski systems.
- **Snowplane** means a self-propelled vehicle intended for oversnow travel and driven by an air-displacing propeller.

ELEMENTS COMMON TO ALL ALTERNATIVES

The following describes elements of the alternatives that are common to all alternatives, including the no-action alternative.

ADMINISTRATIVE USE

Non-recreational, administrative use of snowmobiles would be allowed by park personnel or parties duly permitted under the provisions of 36 CFR 1.6, or other applicable permit authority. Permitted parties must use snowmobiles that meet BAT requirements unless specifically authorized otherwise by the park superintendent. Such use would not be subject to commercial guide requirements.

Administrative use of snowmobiles may be supplemented with administrative snowcoaches. When administrative snowmobiles are necessary, the NPS would generally use snowmobiles meeting BAT requirements. Some snowmobiles that do not meet BAT requirements would be permitted for law enforcement, search and rescue, and other administrative purposes on a limited basis.

Contractors, researchers, and other partners working in the park would be encouraged to use snowcoaches or they would be required to use snowmobiles that meet BAT requirements unless machines that do not meet BAT requirements are necessary for a particular project and are approved in advance of use by the NPS.

NPS employees and their families living in the interior of Yellowstone (and their guests) may continue to use snowmobiles. Subject to available funding, the NPS would provide snowcoaches and snowmobiles that meet BAT requirements for employee use. Beginning in the 2011/2012 season, all employee-owned snowmobiles operated in the park must meet BAT requirements and guests of these employees must use snowmobiles that meet BAT requirements or snowcoaches.

Concessioners and their employees and families living in the interior of Yellowstone (and their guests) may continue to use snowmobiles. Beginning in the 2011/2012 season, all concessioner employee-owned snowmobiles operated in the park must meet BAT requirements. Exceptions, such as access to power and telephone systems, would be granted on a limited basis. Families and guests of these concessioner employees must also use snowmobiles that meet BAT requirements or snowcoaches.

Administrative OSV travel by NPS employees, their families, and their guests and by concession employees, their families, and their guests would be allowed only on groomed roads that meet safety criteria and that are identified for open for travel (exceptions could be made for administrative law enforcement and administrative search and rescue activities).

ACCESSIBILITY

All alternatives would continue implementation of transition and action plans for accessibility and support the philosophy of universal access in the park. The NPS would continue to make reasonable efforts to ensure accessibility to buildings, facilities, programs, and services.

The NPS would develop strategies to ensure that new and renovated facilities, programs, and services (including those provided by concessioners) are designed, constructed, or offered in conformance with applicable policies, rules, regulations, and standards, including but not limited to the Architectural Barriers Act of 1968, the Americans with Disabilities Act of 1990, the Rehabilitation Act of 1973, the Uniform Federal Accessibility Standards of 1984, and the Guidelines for Outdoor Developed Areas of 1999. The NPS would evaluate existing buildings and existing and new programs, activities, and services, including telecommunications and media, to determine current accessibility and usability by disabled winter visitors.

PLOWED ROADS

At a minimum, under all alternatives the following roads would continue to be plowed and private wheeled vehicles would be permitted:

- North entrance to Mammoth Hot Springs
- Mammoth Hot Springs to Upper Terrace Drive

- Mammoth Hot Springs to Tower Junction and the northeast entrance
- Roads within the developed areas at Mammoth Hot Springs, Tower Ranger Station, Lamar Ranger Station, northeast entrance, and Gardiner

Sand, or an equally environmentally neutral substance, may be used for traction on all plowed winter roads. No salt would be used and sand would be generally spread only in the shaded, icy, or hilly areas of plowed roads. Before spring opening, sand removal operations would be conducted on all plowed park roads.

NON-MOTORIZED ACCESS

- Non-motorized uses include cross-country skiing, backcountry skiing, hiking, and snowshoeing. Where feasible, the park would continue to set tracks for skiing on snow road edges. Backcountry non-motorized use would continue to be allowed in most of the park (see the exception for sensitive areas under “Elements Common to all Action Alternatives” below), subject to the Winter Severity Index program. The program restricts backcountry use of the park when winter snowpack and weather conditions become severe and appear to be adversely affecting wildlife.
- Ski and snowshoe use at the south and east entrances would be allowed to continue after roads close for the winter season (to allow for spring plowing). When spring plowing operations approach entrances, the roads would then be closed to skiing and snowshoeing for safety concerns. Bear management closures of the park’s backcountry would continue as in previous years, preventing non-motorized use in these areas.
- Sensitive areas within the inner gorge of the Grand Canyon of the Yellowstone and McMinn Bench bighorn sheep area would continue to be closed to recreational winter use to provide for protection of sensitive resources.

EMERGENCY ACTIONS

None of the alternatives preclude closures for safety or resource protection. The superintendent would continue to have the authority to take emergency action to protect park resources or values.

MANAGEMENT ZONES

For all alternatives, the parks are divided into four management zones, as described below. Zones and their definitions do not change by alternative, although the intensity definition thresholds for each impact category may differ between the zones. Each zone is compared to one of the land classifications used under the Recreation Opportunity Spectrum (ROS), a recognized framework for inventorying, planning, and managing the recreational experience and setting of federal lands.

Developed Area. Areas in the direct influence of human development and dominated by human structures. These range in size from small areas, such as the Indian Creek warming hut, to large areas, such as Old Faithful. Structures include buildings, sewage treatment facilities, campgrounds, employee housing areas, maintenance yards and structures, boardwalks, hotels, and lodges. This zone is most similar to ROS classes “Rural” and “Urban.” It includes areas within 100 yards of developed areas (but does not include backcountry cabins or utility lines).

Road Corridor. Areas directly influenced by roads; specifically, all primary and secondary roads open to either visitor or administrative motorized travel in the winter. As with the developed area, this zone extends out to 100 yards on either side of the road’s center line. This zone is most similar to ROS class

"Roaded Natural." Note that this zone for purposes of this draft Winter Use Plan and Environmental Impact Statement (plan/EIS) would not include roads open in the summer to motorized use but closed in the winter to OSV use. Boardwalks and some utility lines would appear in this zone, but no buildings (which are zoned as developed areas).

Transition Zone. Areas indirectly influenced (mainly by sight and sound) by developed areas and roads. Specifically, they include all areas between 100 yards and 1.5 miles from either a developed area or a road corridor. This zone would include those roads not open to OSV travel in winter (with the possible exception of NPS authorized ski trail grooming equipment) but which may be open to motorized travel in summer. Yellowstone's Blacktail Plateau Drive, Bunsen Peak Road, and Lone Star Geyser Trail are examples of secondary roads included within transition zones. For Grand Teton, examples of areas designated as transition zones include the Teton Park Road and Jackson Lake. When a groomed ski trail is designated a transition zone, the zone would be 100 yards on either side of the groomed trail's center line. This zone would be most similar to ROS class "Roaded Natural" within 1/2 mile of roadways. From 1/2 mile to 1.5 miles from roads, "Semi-Primitive Non-motorized" would be the nearest ROS class or, as is sometimes used, "Semi-Primitive Wilderness," since these areas are recommended wilderness. Some utility lines could appear within this zone.

Backcountry. Areas where natural sights, sounds, and smells dominate and human-caused activities are minimal or completely absent. Specifically, this zone includes all areas more than 1.5 miles from the nearest road or developed area. This zone would be most similar to the "Primitive" ROS class.

RESEARCH PROGRAM

The NPS would continue monitoring park resources; however, this may not be at the same levels or with the same research designs that have occurred in past years. This would provide the NPS with the ongoing information necessary to assess the impacts resulting from implementation of any alternative on park resources and values, visitor access, and to make adjustments, as appropriate, in winter use management.

EDUCATION AND OUTREACH

Under all alternatives, the park would continue to focus on education efforts directed to visitors in wheeled vehicles along the northern road to Cooke City. The visitor center in Mammoth Hot Springs would remain open to the public during the winter.

NO-ACTION ALTERNATIVE

ALTERNATIVE 1: NO-ACTION – NO SNOWMOBILE/SNOWCOACH USE

The Council on Environmental Quality (CEQ) requires that the alternatives analysis in an EIS "include the alternative of no action" (40 CFR 1502.14(d)). The no-action alternative is developed for two reasons. First, a no-action alternative may represent the agency's past and current actions or inaction on an issue continued into the future, which may represent a viable alternative for meeting the agency's purpose and need. If this alternative were implemented, Yellowstone would be operated like many northern-tier national parks (Glacier, Mt. Rainier, Lassen Volcanic, for example) that have limited wheeled vehicle access during the winter. Second, a no-action alternative may serve to set a baseline of existing impacts continued into the future against which to compare the impacts of the action alternatives (Director's Order 12, NPS 2001 section 2.7).

Under alternative 1, the 2009 interim rule (allowing up to 318 snowmobiles and 78 snowcoaches) expired on March 15, 2011. Therefore, OSV use in the winter would no longer be permitted, but non-motorized access and wheeled vehicle use along the northern road would still be allowed.

Under the no-action alternative, primary visitor access would be via wheeled vehicles from Yellowstone's north to northeast entrances. Yellowstone would be accessible for skiing and snowshoeing and the backcountry would remain open. Because there would be no motorized use in the interior of the park, the winter use season would begin once enough snow accumulates to allow for non-motorized uses. The east entrance road would be managed as backcountry, no administrative OSV travel would be allowed, and avalanche control operations would not be conducted along Sylvan Pass during the winter season. The park could be closed for wildlife management; for example during particularly harsh winters, certain portions of the park could be closed to skiing and snowshoeing to minimize impacts on wildlife.

ACTION ALTERNATIVES

Under the action alternatives, OSV use would be managed in the park. The action alternative descriptions provide details about the types of OSV use, as well as the level and location of OSV use.

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

The following describes elements of the management actions common to all of the action alternatives.

Best Available Technology

- At a minimum, BAT would continue to be required for snowmobiles, following the same BAT requirements that are currently in place. Individual alternatives may include additional BAT requirements, as noted below. Specific BAT requirements would include the following:
  - Air emission requirements: Emission levels would be no greater than 120 grams per kilowatt hour (g/kW-hr) of CO and 15 g/kW-hr for HC.
  - Sound emission requirements: Sound restrictions would require a snowmobile to operate at or below 73 decibels measured using the A scale (dB(A)) while at full throttle, according to Society of Automotive Engineers J192 test procedures (revised 1985) (SAE J192).
- BAT guidelines would be developed and implemented for snowcoaches by the 2014/2015 season. Snowcoach BAT requirements would require vehicles to meet Model Year 2010 (or newer) U.S. Environmental Protection Agency (EPA) emission standards because of the 2014/2015 winter season and would also require that by 2014/2015, noise from OSVs must not exceed 73 dBA when operating at or near full speed.
- For any class of OSV, if the EPA adopts standards that are more stringent than the requirements resulting from this draft plan/EIS, the EPA standards would become the NPS standards.
- As part of limiting sound and pollution from OSVs, idling would be limited to no more than 5 minutes at any one time.

Personal Protective Equipment

Personal protective equipment is recommended for snowmobilers, including helmet, snowmobile suit and gloves, proper footwear, and hearing protection. People traveling by snowcoach should also wear or have access to appropriate personal protective equipment including winter clothing, footwear, and hearing protection. Non-motorized users are recommended to wear and carry personal protective equipment as appropriate for their winter travel. For all user groups, personal protective equipment should include avalanche rescue gear (shovel, probe, and transceiver), as appropriate.

Licensing and Registration

- OSV drivers must possess a valid motor vehicle driver's license. A learner's permit does not satisfy this requirement. The driver must carry a license at all times.
- Snowmobiles must be properly registered and display a valid registration from a state or province in the United States or Canada, respectively.

Speed Limits

- Maximum speed for all OSVs would be 45 miles per hour (mph). Speed limits could be lower in more congested areas or in wildlife sensitive corridors. For example, between West Yellowstone and Old Faithful the speed limit would be 35 mph. In developed areas, the speed limit would be 15 to 25 mph.

OSV Routes

- OSV use would continue to be allowed only on designated routes, which are groomed roads that normally provide wheeled vehicle access in the summer. These winter use roads are shown in figure 2 for alternatives 2, 3, 5 6 and 7 and figure 3 for alternative 4. No off-road or off-route OSV use would be permitted.
- The snowmobile route to Cave Falls would continue to operate. This route would be approximately one mile into the park to Cave Falls (a dead end). Up to 50 snowmobiles could enter this area per day; these snowmobiles would not be required to meet BAT requirements. This area would be exempt from commercial guiding and BAT requirements because the one-mile, dead-end route does not connect to other snow roads in the park, and these requirements would be not applicable to a one mile stretch of road. The 50 snowmobile limit for the Cave Fall route would not be part of the snowmobile limits discussed below under the action alternatives.
- The park may open or close all designated oversnow routes, or portions thereof, in consideration of the location of wintering wildlife, adequate snowpack, public safety, and other factors related to safety and resource protection. New routes for snowcoaches could be established based on these same factors. All routes designated for snowmobile use would be open to snowcoaches.

OSV Management

- Early and late entries for special tours would not be permitted, including departures from Snow Lodge. Limited exceptions would be allowed for administrative travel and emergencies.

FIGURE 2: OSV ROUTES UNDER ALTERNATIVES 2, 3, 5, AND 6

FIGURE 3: OSV AND WHEELED VEHICLE ROUTES UNDER ALTERNATIVE 4

Non-motorized Use Areas

- Approximately 35 miles of road would continue to be groomed for cross-country skiing in the park. These roads are mainly used during the summer, and are closed to OSV use. The roads may be machine groomed for skiing. Existing and new routes could be evaluated in the future, and changes announced through one or more of the methods listed in 36 CFR 1.7(a). Existing groomed areas for cross country skiing include the following:
  - Bunsen Peak Trail: 6 miles
  - Indian Creek Loop: 2.2 miles
  - Upper Terrace Loop Trail: 1.5 miles
  - Old Canyon Bridge Trail: 1 mile
  - Lone Star Geyser Trail: 2 miles
  - Practice Ovals: 0.3 mile
  - Cloverleaf: 0.8 mile
  - Cabin Track: 0.4 mile
  - East Road Track: 0.9 mile
  - Morning Glory Trail: 3 miles
  - Black Tail Plateau Trail: 8 miles
  - Tower Falls Trail: 2.5 miles
  - Chittenden Loop Trail: 5.3 miles
  - Riverside Trail: 1 mile

  In addition to the machine groomed roads, parallel tracks are set on the sides of some of Yellowstone's snow roads, typically including the west entrance to Madison (14 miles one way); Madison to Old Faithful (16 miles one way); and Madison to Norris (12 miles one-way). These are established each time the road is groomed (every two or three days) and may be obliterated by snowcoach and snowmobile travel.

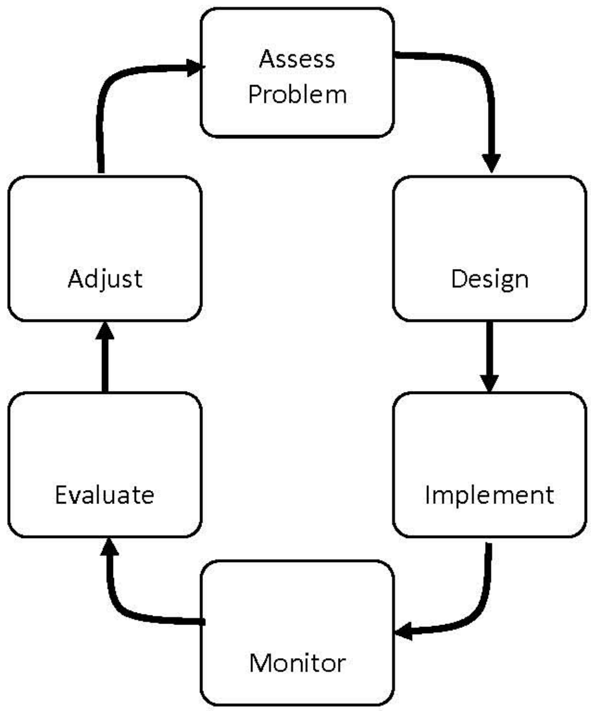
Sylvan Pass Avalanche Control

For action alternatives that include maintaining Sylvan Pass for OSV access (all alternatives, excluding alternative 4), a combination of avalanche mitigation techniques may be used, including forecasting and helicopter and howitzer dispensed explosives. The results of the most recent safety evaluation of Sylvan Pass by the Occupational Safety and Health Administration and an Operational Risk Management Assessment would be reviewed and the NPS would evaluate additional avalanche mitigation techniques and risk assessment tools to further improve safety and visitor access. All actions implemented would take into consideration the implementation of the Sylvan Pass Working Group Agreement, allowing for the East Entrance to be open from 8:00 a.m. to 9:00 p.m. with the road open to OSVs from December 22 through March 1.

Adaptive Management

Adaptive management—learning by doing—is an important tool for resource management. It is based on the assumption that current scientific knowledge is limited and a level of uncertainty exists. In 2007, the Department of the Interior released its Adaptive Management Technical Guide, defining the term and providing a clear process for building adaptive management processes into natural resource management (Williams et al. 2007). In 2008, the Department of the Interior codified the definition in regulation stating that adaptive management is "a system of management practices based on clearly identified outcomes and monitoring to determine whether management actions are meeting desired outcomes; and, if not, facilitating management changes that will best ensure that outcomes are met or re-evaluated" (43 CFR § 46.30). The Department regulations also direct its agencies to use adaptive management (43 CFR § 46.145).

Adaptive management is a continuing iterative process where a problem is first assessed, potential management actions are designed and implemented, those actions and resource responses are monitored over time, that data is evaluated, and actions are adjusted if necessary to better achieve desired management outcomes (see figure 4).



Source: Williams et al. 2007

FIGURE 4: GENERAL ADAPTIVE MANAGEMENT PROCESS DIAGRAM

All action alternatives incorporate adaptive management initiatives that are designed to assist the park in meeting the objectives of this draft plan/EIS. The adaptive management strategy is provided in appendix A.

DISCUSSION OF ACTION ALTERNATIVES

ALTERNATIVE 2: CONTINUE SNOWMOBILE/SNOWCOACH USE AT 2008 PLAN LIMITS

Alternative 2 would continue winter use at levels similar to the 2009 interim rule, which allowed for up to 318 snowmobiles and 78 snowcoaches per day in Yellowstone on the routes shown in figure 2. This alternative represents the continuation of conditions in the park that were in place for the 2009/2010 and 2010/2011 seasons and incorporates concepts of fixed management (no daily variability in OSV numbers or sharing of allocations between gates) to provide predictability to the visitor and park staff. Routes open to snowmobiles and snowcoaches would remain the same as detailed in the 2009 interim rule (and restated below). Sylvan Pass (east entrance road) would be open for OSV travel in accordance with the Sylvan Pass Working Group agreement.

Snowmobile Management. The NPS would permit up to 318 snowmobiles per day into Yellowstone, which would not vary, all of which must meet BAT requirements. In addition to those listed under “Elements Common to all Action Alternatives,” the following road segments would be groomed for snowmobile use (see figure 2):

- Grand Loop Road, from its junction with Upper Terrace Drive to Norris Junction
- Norris Junction to Canyon Junction

- Grand Loop Road, from Norris Junction to Madison Junction
- West entrance road, from the park boundary at West Yellowstone to Madison Junction
- Grand Loop Road, from Madison Junction to West Thumb
- South entrance road, from the south entrance to West Thumb
- Grand Loop Road, from West Thumb to its junction with the east entrance road
- East entrance road, from Fishing Bridge Junction to the east entrance
- Grand Loop Road, from its junction with the east entrance road to Canyon Junction
- South Canyon Rim Drive
- Lake Butte Road
- Firehole Canyon Drive, 12:00 to 9:00 p.m. only
- North Canyon Rim Drive, 12:00 to 9:00 p.m. only
- Riverside Drive, 12:00 to 9:00 p.m. only
- Roads in the developed areas of Madison Junction, Old Faithful, Grant Village, West Thumb, Lake, east entrance, Fishing Bridge, Canyon, Indian Creek, and Norris.

Management of snowmobile use under alternative 2 would require all snowmobiles in the park to travel with a commercial guide affiliated with a commercial guiding service and authorized by contract to operate in the park. No more than 11 snowmobiles would be permitted per group, including at least one commercial guide. Visitors would pay the park entrance fee and a commercial guide fee.

Entrance allocations would be fixed, meaning each entrance would only allow entry to its assigned number of snowmobiles per day. The exception would be Old Faithful and the north entrance, whose operator (currently Xanterra) could share allocations. See table 1 for specific entrance allocation numbers.

TABLE 1: YELLOWSTONE DAILY SNOWMOBILE ENTRY LIMITS UNDER ALTERNATIVE 2

Entrance	Commercially Guided Snowmobiles
West Entrance	160
South Entrance	114
East Entrance	20
North Entrance	12
Old Faithful	12
Total	318

Under alternative 2, some of the side roads would continue to be groomed for non-motorized uses, and others would allow certain types of OSV only during certain time periods. For example, some roads would allow snowcoaches only in the morning, and snowmobile and snowcoaches in the afternoon.

Under the proposed snowmobile numbers, 413 daily snowmobile passengers are estimated.

Snowcoach Management. The NPS would permit up to 78 snowcoaches per day into Yellowstone. In addition to the snowmobile routes listed above, the following routes would be open to slowcoach:

- Firehole Canyon Drive, all day (7:00 a.m. to 9:00 p.m.)
- Fountain Flat Road
- North Canyon Rim Drive, all day (7:00 a.m. to 9:00 p.m.)
- Grand Loop Road from its junction with Upper Terrace Drive to its junction with north entrance Road (rubber-tracked coaches only)
- Roads in the developed area of Mammoth Hot Springs (rubber-tracked coaches only)
- Grand Loop Road, from Canyon Junction to the Washburn Hot Springs overlook.

All snowcoaches operating in the park would be required to operate in accordance with a concessions contract. Private snowcoaches would not be allowed. Entrance allocations would be fixed, meaning each entrance would only allow entry to its assigned number of snowcoaches per day (as with snowmobiles, Xanterra allocations at North and Old Faithful could be shared). See table 2 for specific entrance allocation numbers. Visitors would pay the park entrance fee and those charged by the snowcoach operator.

TABLE 2: YELLOWSTONE DAILY SNOWCOACH ENTRY LIMITS UNDER ALTERNATIVE 2

Entrance	Commercially Guided Snowcoaches
West Entrance	34
South Entrance	13
North Entrance	13
East Entrance	2
Old Faithful	16
Total	78

Under these proposed allotted snowcoach numbers, 624 daily snowcoach passengers are estimated.

Limited snowcoach use would be allowed to provide drop-offs for non-motorized use up to six miles west of the east entrance from March 2 to March 15 to access non-motorized recreational opportunities (see non-motorized use management under "Elements Common to All Alternatives").

Wheeled Vehicle Management. Under alternative 2, wheeled vehicle access would continue as described under "Elements Common to All Alternatives."

Non-Motorized Use Management. Under alternative 2, non-motorized uses would continue as described under "Elements Common to All Alternatives."

Dates of Operation and Transition to New Plan. Under alternative 2, conditions existing during the winter seasons of 2009/2010 and 2010/2011 would continue and a transition period would not occur. The winter season dates, December 15 to March 15, would remain the same. Hours of operation for OSV use would be between 7:00 a.m. and 9:00 p.m.

ALTERNATIVE 3: RETURN SNOWMOBILE/SNOWCOACH USE TO 2004 PLAN LIMITS

Alternative 3 would allow winter use levels up to 720 snowmobiles and 78 snowcoaches per day in Yellowstone on the routes shown in figure 2. This alternative represents the 2004 winter use plan conditions in the park and incorporates the concept of fixed management (no daily variability in OSV numbers or sharing of allocations between gates) to provide predictability visitors and park staff. Routes open to snowmobiles and snowcoaches would remain the same as detailed in the 2009 interim rule (and outlined under alternative 2). Sylvan Pass (east entrance road) would be open for OSV travel in accordance to the Sylvan Pass Working Group agreement.

Snowmobile Management. The NPS would permit up to 720 snowmobiles per day into Yellowstone, all of which must meet BAT requirements and must be commercially guided. Road segments open to snowmobile use under alternative 3 (see figure 2), as well as guide, group size, fees, fixed entrance allocation requirements, and BAT requirements, would be the same as those under alternative 2. See table 3 for specific entrance allocation numbers.

TABLE 3: YELLOWSTONE DAILY SNOWMOBILE ENTRY LIMITS UNDER ALTERNATIVE 3

Entrance	Commercially Guided Snowmobiles
West Entrance	414
South Entrance	246
East Entrance	20
North Entrance	20
Old Faithful	20
Total	720

Under these proposed allotted snowmobile numbers, 936 daily snowmobile passengers are estimated.

Limited snowmobile use would be allowed to provide drop-offs for non-motorized use at the east entrance from March 2 to March 15 to access non-motorized recreational opportunities (see non-motorized use management under "Elements Common to All Alternatives").

Snowcoach Management. The NPS would permit up to 78 snowcoaches per day into Yellowstone, with snowcoach routes the same as those described for alternative 2.

All snowcoaches operating in the park would be required operate in accordance with a concessions contract and daily entrance numbers would be fixed, as described under alternative 2 (as with snowmobiles, Xanterra allocations at the north entrance and Old Faithful could be shared). See table 4 for specific entrance allocation numbers.

TABLE 4: YELLOWSTONE DAILY SNOWCOACH ENTRY LIMITS UNDER ALTERNATIVE 3

Entrance	Commercially Guided Snowcoaches
West Entrance	34
South Entrance	13
North Entrance	13
East Entrance	2
Old Faithful	16
Total	78

Under these proposed allotted snowcoach numbers, 624 daily snowcoach passengers are estimated.

Wheeled Vehicle Management. Under alternative 3, wheeled vehicle access would continue as described under "Elements Common to All Alternatives."

Non-Motorized Use Management. Under alternative 3, non-motorized uses would continue as described under "Elements Common to All Alternatives."

Dates of Operation and Transition to New Plan. Under alternative 3, a transition period of one year would occur; under which time the daily limits and management under the 2009 interim rule (in effect for the winters of 2009/2010 and 2010/2011) would be in effect. The winter season dates, December 15 to March 15, would remain the same. Hours of operation for OSV use would be between 6:00 a.m. and 9:00 p.m. (8:00 a.m. to 9:00 p.m. for the east entrance).

ALTERNATIVE 4: MIXED-USE: SNOWCOACHES, SNOWMOBILES, AND ROAD PLOWING FOR WHEELED VEHICLES

Under this alternative, OSVs would be able to enter the park from the south entrance with levels of up to 110 snowmobiles and 30 snowcoaches per day. Upper Terrace Drive in Mammoth and the west entrance would be open to commercial wheeled vehicles but not private vehicles. Some side roads would be designated as ski/snowshoe only routes. See figure 3 for OSV and wheeled vehicle routes under alternative 4.

Under alternative 4, Sylvan Pass (the east entrance) would be closed to snowmobiles and snowcoaches. Non-motorized use at the east entrance would include a backcountry experience along this route.

Snowmobile Management. The NPS would permit up to 110 snowmobiles per day into Yellowstone, all of which would meet BAT requirements. The following road segments, in addition to those listed under "Elements Common to all Action Alternatives," would be groomed for snowmobile use (see figure 3):

- Norris Junction to Canyon Junction
- Grand Loop Road, from Old Faithful to West Thumb
- South entrance road, from the south entrance to West Thumb
- Grand Loop Road, from West Thumb to its junction with the east entrance road
- East entrance road, from the Fishing Bridge Junction to Lake Butte Overlook
- Grand Loop Road, from its junction with the east entrance road to Canyon Junction
- Grand Loop Road, from Canyon Junction to the Washburn Hot Springs Overlook
- South Canyon Rim Drive
- Lake Butte Road
- North Canyon Rim Drive
- Roads in the developed areas of Grant Village, West Thumb, Lake, Fishing Bridge, and Canyon
- Roads in the developed areas of Old Faithful, and Norris (also open to wheeled vehicle).

Management of snowmobile use under alternative 4 would require all snowmobiles in the park, except those on Cave Falls Road, to travel with a commercial guide affiliated with a commercial guiding service and authorized by contract to operate in the park. There would be no more than 11 snowmobiles permitted per group, including at least one commercial guide. Visitors would pay the park entrance fee and a commercial guide fee.

Entrance allocations could be flexible between the three areas where snowmobile use initiates, depending on demand at each area. For example, if there is greater demand for tours from Old Faithful, that allocation could increase, with a corresponding decrease in the allocation in other areas. See table 5 for specific entrance allocation numbers.

TABLE 5: YELLOWSTONE DAILY SNOWMOBILE ENTRY LIMITS UNDER ALTERNATIVE 4

Entrance	Commercially Guided Snowmobiles
South Entrance	66
Old Faithful	22
Norris	22
Total	110

Note: allocations could be shared between the three entrances on a daily basis as long as no more than 110 snowmobiles are operating at one time.

Under these proposed allotted snowmobile numbers, 143 daily snowmobile passengers are estimated.

Snowcoach Management. The NPS would permit up to 30 snowcoaches per day into Yellowstone departing from one of three points: the south entrance, Norris, or Old Faithful. The routes for snowcoaches under alternative 4 would be the same as those for snowmobiles described above. In addition, the east entrance road from the entrance to a point approximately six miles west, would be open to snowcoaches to allow for non-motorized use drop off.

All snowcoaches operating in the park would operate in accordance with a concessions contract. Private snowcoaches would not be allowed. Daily snowcoach levels would be fixed. Entrance allocations would be flexible and based on the demand at the three snowmobile entrance locations as described for snowmobiles. See table 6 for specific entrance allocation numbers.

TABLE 6: YELLOWSTONE DAILY SNOWCOACH ENTRY LIMITS UNDER ALTERNATIVE 4

Entrance	Commercially Guided Snowcoaches
South Entrance	20
Old Faithful	8
Norris	2
Total	30

Note: allocations could be shared between the three entrances on a daily basis as long as no more than 30 snowcoaches are operating at one time.

Under these proposed allotted snowcoach numbers, 240 daily snowcoach passengers are estimated.

Wheeled Vehicle Management. Under alternative 4, in addition to wheeled vehicle access on the northern road, the north (Upper Terrace Drive) and west (West Yellowstone) entrance roads would be plowed to Old Faithful to accommodate multi-passenger commercial vehicles (e.g., vans and buses). No private vehicles would be allowed. A daily limit of up to 100 Tier 2 or model year 2007 diesel (or newer)

(EPA standard) vehicles would be permitted. Visitors would pay the park entrance fee and a commercial guide fee. Specific routes in the park that would be plowed and opened to commercial wheeled vehicles include the following:

- Grand Loop Road, from its junction with Upper Terrace Drive to Norris Junction
- Grand Loop Road, from Norris Junction to Madison Junction
- West entrance road, from the park boundary at West Yellowstone to Madison Junction
- Grand Loop Road, from Madison Junction to Old Faithful
- Roads in the developed areas of Madison, Old Faithful, and Norris (also open to OSV use).

Under these proposed allotted wheeled vehicle numbers, 2,000 daily wheeled vehicle passengers are estimated.

Non-Motorized Management. Non-motorized uses include cross-country skiing, backcountry skiing, hiking, and snowshoeing. Use would be subject to the Winter Severity Index program. This program restricts backcountry use of the park when winter snowpack and weather conditions become severe and appear to be adversely affecting wildlife.

Under alternative 4, the park would continue to groom 35 miles of secondary roads available for cross-country skiing and snowshoeing, as described under “Elements Common to All Alternatives.” These roads are mainly used during the summer and are closed to OSV use. Approximately 10 miles of additional secondary roads would be groomed for non-motorized use access at various stopping points along the plowed roads. These points would include the following:

- Firehole Canyon Drive
- Riverside Drive
- Fountain Flat Road.

Dates of Operation, Transition to New Plan, and Facility Construction. Under alternative 4, there would be a transition period of one year, during which time the daily limits and management under the 2009 interim rule (in effect for the winters of 2009/2010 and 2010/2011) would be in effect. The winter season dates, December 15 to March 15, would remain the same. Hours of operation for OSV use would be between 6:00 a.m. and 9:00 p.m. Alternative 4 would include the construction of a warming hut at Norris and a maintenance facility in the West Entrance administrative area to accommodate the multiple uses occurring within the park and to allow wheeled vehicle visitors to use OSV once inside the park.

Alternative 5: Transition to Snowcoaches that meet BAT Requirements Only

Under alternative 5, OSV access into the park could transition towards snowcoaches only, all of which must meet BAT requirements. This would be accomplished by allowing snowcoaches to replace snowmobiles beginning in the 2014/2015 winter season, when all snowcoaches must meet BAT requirements. Snowcoaches could replace snowmobiles within a five-year period. As more snowcoaches meet BAT requirements, the number of snowmobiles would decrease. The transition to snowcoach only could be driven by user demand, or mandated by the park. Sylvan Pass road grooming would be managed in accordance with the Sylvan Pass Working Group agreement. Non-motorized use would continue as described under “Elements Common to All Alternatives” and approximately 10 miles of side roads would become ski/snowshoe routes.

Snowmobile Management. Alternative 5 would initially permit up to 318 snowmobiles meeting BAT requirements per day into Yellowstone from the 2011/2012 season until the 2014/2015 season. Daily snowmobile limits and entrance allocations during this time would be the same as under alternative 2 (refer to table 1 for specific entrance allocation numbers). The 2014/2015 winter season would begin a transition period with gradual reduction in snowmobiles as the number of snowcoaches meeting BAT requirements increases. After the transition, recreational snowmobile use could be reduced down to zero per day.

To achieve this alternative, the park would issue a prospectus that would allow for both guided snowmobile and snowcoach services. Each company that wins a contract would be given an allocation of snowmobiles and snowcoaches. The snowmobile totals of all contracts would not exceed 318. For snowcoaches each contract would have an allocation that initially would equal a total of 78 coaches between all providers and could grow to a total of 120. At the end of each winter season, the NPS would request to know the number of BAT snowcoaches coming on–line the following season from each OSV tour company. The tour company could request to replace snowmobiles with snowcoaches. For each snowcoach added, a reduction of seven snowmobiles would occur. Once the last snowcoach under each contract is added, if there are any remaining snowmobiles under that contract, they would be replaced by the last snowcoach (that is the last snowcoach might replace anywhere from 7 to 12 snowmobiles).

Although the focus of this alternative is a transition to snowcoaches, with changing snowmobile technology, this alternative could allow operators to replace BAT snowcoaches with improved technology snowmobiles in the future. The NPS is aware of development of electric snowmobiles; prototype models are approaching the capability of travelling from West Yellowstone to Old Faithful and back on a single charge. Also the Society of Automotive Engineers (SAE) Clean Snowmobile Challenge has demonstrated that advanced technology snowmobiles are possible and can reach the same emission levels as the cleanest snowcoaches available. In the future, this alternative would allow an operator to replace BAT coaches with electric, hybrid, or low emission snowmobiles as long as the combined CO+HC+ NO_x emissions do not exceed 50 grams per mile (or the equivalent grams per kilowatt-hour) and the sound level is less than 70 dbA, when measured by current J192 test procedures.

Under one option within this alternative, OSV operators may continue to operate both BAT snowmobiles and BAT snowcoaches, within the specified numerical ranges, depending on visitor desires for access. A second option would be an NPS-mandated phase out of snowmobiles within a five-year period (beginning in 2014/2015).

Routes available to snowmobile use would include the following (also see figure 2):

- Grand Loop Road, from its junction with Upper Terrace Drive to Norris Junction
- Norris Junction to Canyon Junction
- Grand Loop Road, from Norris Junction to Madison Junction
- West entrance road, from the park boundary at West Yellowstone to Madison Junction
- Grand Loop Road, from Madison Junction to West Thumb
- South entrance road, from the south entrance to West Thumb
- Grand Loop Road, from West Thumb to its junction with the east entrance road

- East entrance road, from Fishing Bridge Junction to the east entrance
- Grand Loop Road, from its junction with the east entrance road to Canyon Junction
- South Canyon Rim Drive
- Lake Butte Road
- North Canyon Rim Drive
- Roads in the developed areas of Madison Junction, Old Faithful, Grant Village, West Thumb, Lake, east entrance, Fishing Bridge, Canyon, Indian Creek, and Norris.

Management of snowmobile use under alternative 5 would require all snowmobiles in the park, except those on Cave Falls Road, to travel with a commercial guide who is affiliated with a commercial guiding service and is authorized by contract to operate in the park. There would be no more than 11 snowmobiles permitted per group, including at least one commercial guide. Visitors would pay the park entrance fee, as well as a commercial guide fee.

Daily snowmobile levels would be fixed for the season and would not vary during the season. As snowmobile numbers are reduced each season, those daily entrance levels would also be fixed. Entrance allocations would be flexible, based on entrance demand. This could be accomplished through sharing between the entrances of west, south, east, north, and Old Faithful. See table 7 for specific initial entrance allocation numbers. As the number of snowmobiles in the park decreases during the transition period, there would be a corresponding decrease to the entrance allocations.

TABLE 7: INITIAL YELLOWSTONE DAILY SNOWMOBILE ENTRY LIMITS UNDER ALTERNATIVE 5

Entrance	Commercially Guided Snowmobiles
West Entrance	160
South Entrance	114
East Entrance	20
North Entrance	12
Old Faithful	12
Total	318

*Note: allocations could be shared between the entrances on a daily basis as long as no more than 318 snowmobiles are operating at one time.

Under these proposed allotted snowmobile numbers, 413 daily snowmobile passengers when 318 snowmobiles are estimated, and could reach zero snowmobile passengers at the end of the phase out.

Snowcoach Management. The NPS would permit up to 78 snowcoaches per day into Yellowstone from the 2011/2012 season until the 2014/2015 season. Starting in the 2014/2015 season, all 78 snowcoaches must meet BAT requirements. Daily snowcoach limits initially would be the same as under alternative 2 (refer to table 2 for specific entrance allocation numbers). As of the 2014/2015 winter season, the daily snowcoach limit could increase to 120, with each new snowcoach also required to meet BAT requirements. The 2014/2015 season would also start the five-year transition period, during which the number of snowcoaches meeting BAT requirements increases and the number of snowmobiles permitted per day could decrease.

To achieve this alternative, the park would issue a prospectus that would allow for both guided snowmobile and snowcoach services, as described above under “Snowmobile Management.” If after five years 120 snowcoaches meeting BAT requirements are available, the permitted snowmobile use level could be zero. If at the end of the transition period 120 snowcoaches meeting BAT requirements are not available, the snowcoach limit would be set at the number of snowcoaches meeting BAT requirements available at that time, and the level of snowmobile use would continue at the number set at that time. For example, if at the end of five years 100 snowcoaches are available, snowmobile levels would be reduced to 164 per day and would remain at this level.

Snowcoach routes under alternative 5 would be the same as snowmobile routes. No separation of uses would occur on these routes (i.e., both snowcoaches and snowmobiles would be allowed on these routes while the park is open to OSV).

All snowcoaches operating in the park would be required operate in accordance with a concessions contract. Private snowcoaches would not be allowed. Daily snowcoach levels would be fixed and there would be no variation in the total number allowed day to day. Entrance allocations could be flexible, based on the demand at the five snowcoach entry locations. Sharing would occur among the west, south, east, north, and Old Faithful entrances. Refer to table 2 for initial Yellowstone daily snowcoach entry limits, which would be adjusted accordingly as the number of snowcoaches increases.

Under these proposed allotted snowcoach numbers, 624 to 960 daily snowcoach passengers are estimated, depending on the stage of the phase out.

Wheeled Vehicle Management. Under alternative 5, wheeled vehicle access would continue as described under “Elements Common to All Alternatives.”

Non-Motorized Management. Non-motorized uses include cross-country skiing, backcountry skiing, hiking, and snowshoeing would continue as described under “Elements Common to All Alternatives.”

Additional secondary roads, approximately 10 miles, would be groomed for non-motorized use access at various stopping points along the plowed roads. These points would be primarily between the west entrance to Old Faithful and would include the following:

- Firehole Canyon Drive
- Riverside Drive
- Fountain Flat Road
- In addition, the east entrance road, from the entrance to approximately 4 miles west would be groomed for skiing.

Dates of Operation and Transition to New Plan. Because alternative 5 begins with alternative 2 (2009 interim rule) provisions, there would be no transition year. Dates of operation would be the same as under alternative 4.

ALTERNATIVE 6: IMPLEMENT VARIABLE MANAGEMENT

Under alternative 6, management of winter use would be structured to increase the variety of winter experiences and create more flexibility in how winter use is managed. OSV levels would vary by creating times and places for higher and lower levels of use. Additional opportunities for undisturbed skiing and snowshoeing would also be created. Sylvan Pass would be managed in accordance with the Sylvan Pass

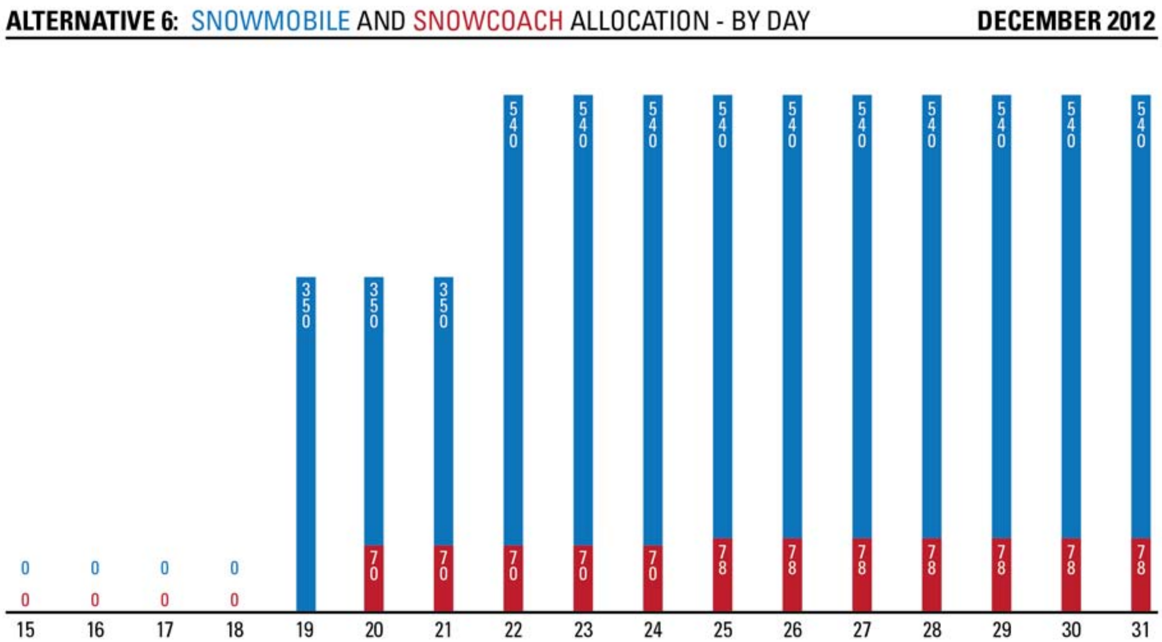
Working Group agreement and the park would continue with road grooming. Certain side roads would be groomed for non-motorized uses only during certain times/days of the season. OSV use would end at West Thumb Junction and at the Canyon developed area for the last two weeks of the season to accommodate more non-motorized snow recreation on the east side of the park.

Snowmobile Management. Alternative 6 would allow up to 32,000 snowmobiles meeting BAT requirements each season, with a daily limit between 0 and 540. Under these proposed allotted snowmobile numbers, an average of 408 daily snowmobile passengers are estimated.

The daily level of snowmobiles permitted would vary (daily, weekly, and monthly) based on a pre-determined seasonal schedule. Based on this schedule, use could be higher on some days and lower on others, but would not exceed 540 on any given day. This would allow the park to accommodate more visitors as well as to implement research projects that would take advantage of the variation in use. During times of higher demand, such as during holiday periods (the week between Christmas and New Year's Day, and Presidents Day weekend), more permits could be issued, and conversely, fewer permits would be provided during other times of the year to balance out use and make sure the overall annual limit is not exceeded. Additionally, permit levels could vary from year to year to provide a range of uses, for example, if snowmobile permits are high one year during holiday weekends, they may be lower the next year to provide for a variety of experiences during these high demand times. Figure 5 provides an example schedule that show how use could be varied throughout the season. If this alternative were selected, actual schedules would be developed.

All existing oversnow routes in the park, as listed under alternative 2, would be open to snowmobile use, with areas subject to occasional closure to allow for non-motorized uses to occur. Alternative 6 would allow for both commercially guided, as well as unguided/non-commercially guided snowmobile use in the park. Group sizes may vary between 11 and 22 snowmobiles, including the guide. Groups of up to 11 would be required to have one guide and groups of between 12 and 22 would be required to have two guides.

Daily entrance allocation for commercially guided groups could be flexible, to provide and accommodate for a variety of winter experiences. For example, daily allocations not used at one gate could be used at another gate that same day. Each day a certain number of permits would be available, with individual operators able to exchange their permits for one day with another operator, for their permit allocation on a different day. As cleaner and quieter OSVs are developed (for example, hybrid snowmobiles or snowcoaches, etc.) the NPS would explore ways to provide incentives for these newer technologies for commercially guided use.



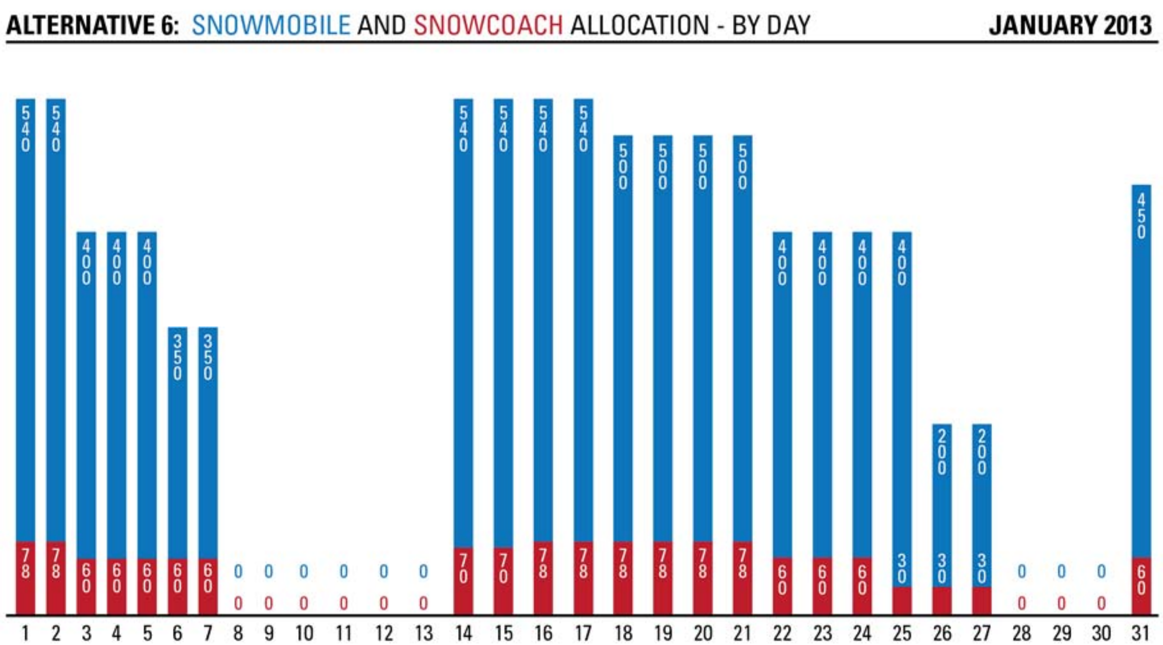
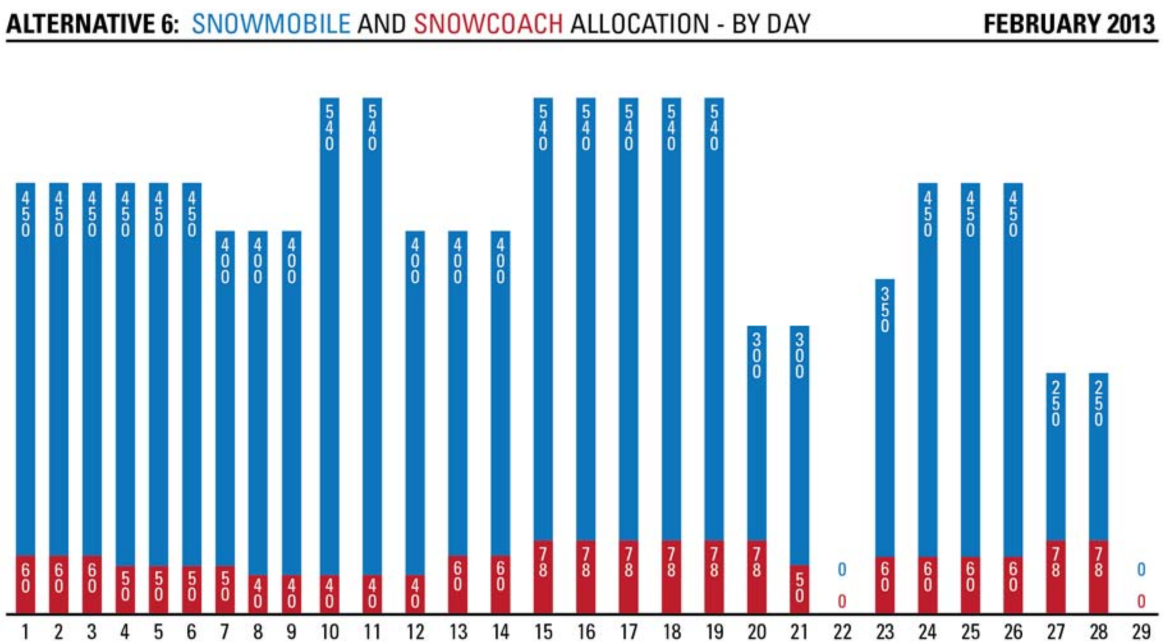


FIGURE 5: EXAMPLE SCHEDULE OF SNOWMOBILE AND SNOWCOACH USE VARIATION IN A SEASON UNDER ALTERNATIVE 6



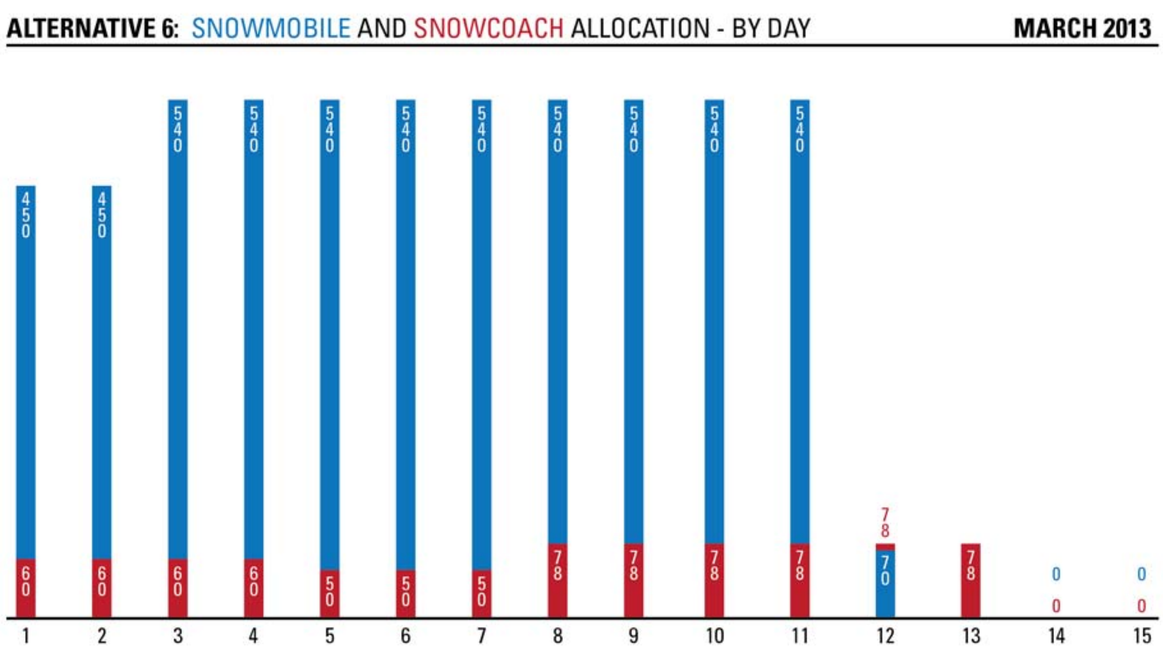


FIGURE 5: EXAMPLE SCHEDULE OF SNOWMOBILE AND SNOWCOACH USE VARIATION IN A SEASON UNDER ALTERNATIVE 6 (CONTINUED)

Alternative 6 would provide for up to 25% of snowmobile use in the park (on a daily basis) to be unguided or non-commercially guided. The percentage could vary, but would not exceed 25%, based on the adaptive management strategy, which would assess the impacts of this type of use. Allowing for unguided/non-commercially guided use could be accomplished in one or more of the following ways:

- Unguided Snowmobiles: When they receive their entrance passes, all park visitors on unguided snowmobiles would be required to attend a short presentation on safety, how to minimize impacts to the park, snowmobile riding etiquette, park regulations, and how to avoid disturbances to wildlife. This presentation could be in person or by video. All members of the unguided group would be required to present a current certificate of completion of a snowmobile safety course administered by a state, province, Tread Lightly, the American Council of Snowmobile Associations, the Canadian Council of Snowmobile Organizations, or other generally recognized certifying organization.
- Non-Commercial Tours with a Certified Group Leader: One member of the tour would be certified by the NPS (or NPS designee) to lead a group of snowmobilers. A Yellowstone-specific certification program, such as the SafeRider! program at www.snowiasa.org would be used or developed. The group leader would be required to present a current certificate of completion of a snowmobile safety course administered by a state, province, Tread Lightly, the American Council of Snowmobile Associations, the Canadian Council of Snowmobile Organizations, or other generally recognized certifying organization.

A special use fee may be charged for managing unguided/non-commercially guided snowmobile use.

Snowcoach Management. Under alternative 6, the NPS would permit up to 4,600 snowcoaches per season. Daily use limits would vary between 0 and 78. Under these proposed allotted snowcoach numbers, 361 daily snowcoach passengers are estimated.

Snowcoach levels would vary (daily, weekly, monthly) based on pre-determined seasonal schedule as shown in figure 5. Based on this schedule, use could be higher on some days and lower on others, but would not exceed 78 in a given day. This would allow the park to accommodate more visitors and to implement research projects that take advantage of the variation in use. During times of higher demand, such as during holiday periods (the week between Christmas and New Year's and Presidents Day weekend), more permits could be issued, and conversely, less permits would be issued during other times of the year to balance out use and make sure the overall annual limit is not exceeded. Additionally, permit levels could vary from year to year to provide a range of uses, for example, if snowcoach permits are high on year during holiday weekend, they may be lower the next year to provide for a variety of experience during these high demand times.

Daily entrance allocations for snowcoaches would be the same as under alternative 2 (refer to table 2), but could be flexible, to provide and accommodate for a variety of winter experiences. For example, daily allocation not used at one entrance could be used at another entrance that same day. Snowcoach routes would be the same as snowmobile routes.

All snowcoaches operating in the park would have to operate in accordance with a concessions contract. Private snowcoaches would not be allowed.

Wheeled Vehicle Management. Under alternative 6, wheeled vehicle access would be allowed continue as described under "Elements Common to All Alternatives."

Non-Motorized Use Management. Non-motorized use would be managed as described under "Elements Common to All Alternatives" except that in addition, certain side roads would become ski and snowshoe routes at certain times of the season, and during these times OSVs would not be permitted in these areas to allow for an experience with more solitude. These ski-snowshoe only side roads could include: Canyon to Washburn Hot Springs Overlook, North Canyon Rim Drive, Riverside Drive, Firehole Canyon Drive, Gull Point Drive, Firehole Lake Drive, Fountain Flat Drive, and other service roads. In addition, OSV use would end at West Thumb Junction and at the South Canyon Rim Drive/Grand Loop junction for the last two weeks of the season (March 2 to March 15) to accommodate more non-motorized snow recreation on the east side of the park.

Dates of Operation and Transition to New Plan. Under alternative 6, the opening and closing dates could vary to accommodate a variety of visitor experiences and needs, but would still take place between December 15 and March 15 of every season. The schedule for each season would be determined at the beginning of the previous season. For example, the schedule for the 2012/2013 season would be released prior to the start of the 2011/2012 season in order to provide both the visitor and concessioner time to prepare of the following season.

Operating hours under alternative 6 would initially be from 6:00 a.m. to 9:00 p.m., but may vary for various uses to accommodate a variety of experience. The NPS could allow non-motorized uses in the morning and OSV use in the afternoon, or the NPS could use another similar management scheme.

A one year transition period to prepare for the implementation of the new winter-use plan would be put in place. Provisions of the 2009 interim rule would continue during this transition.

ALTERNATIVE 7: PROVIDE A VARIETY OF USE LEVELS AND EXPERIENCES FOR VISITORS

Under alternative 7, a variety of proposed use levels would establish a maximum number of snowmobiles and snowcoaches permitted in the park on a given day. There would be four different use levels for each vehicle type; the combination of snowmobile and snowcoach use may change by day. In addition, under alternative 7, all OSVs must enter the park by 10:30 a.m. Daily use levels for the following winter use season would be made available by December 1 of the preceding year. Sylvan Pass would be managed in accordance with the Sylvan Pass Working Group agreement and the park would continue with road grooming.

Snowmobile Management. Under alternative 7, the maximum number of snowmobiles permitted in the park would be separated into four subsets of allowed use throughout the season, each subset allocated between the different entrances. This would be based on the maximum number of snowmobiles allowed, resulting in four different snowmobile caps throughout the winter season. An average of 254 snowmobiles would operate in the park per day for a total of 23,122 per season should the maximum capacity be reached each day throughout the winter season.

Snowmobile use levels (caps) would be based on a pre-determined seasonal schedule, which would be announced one year in advance. The NPS would release this information by December 1 of the preceding year. The schedule would vary by year and be determined by low and high use opportunities during both the holiday season and other times throughout the winter season. An example schedule is shown in figure 6. Daily entrance allocations for groups would be flexible to allow allocations not used at one entrance to be used at another, while still remaining within the pre-set daily use level. Similar to alternative 2, commercially guided snowmobile groups would have a maximum of 11 snowmobiles including the guide. Fees for snowmobile use through commercial operators would continue as described under alternative 2.

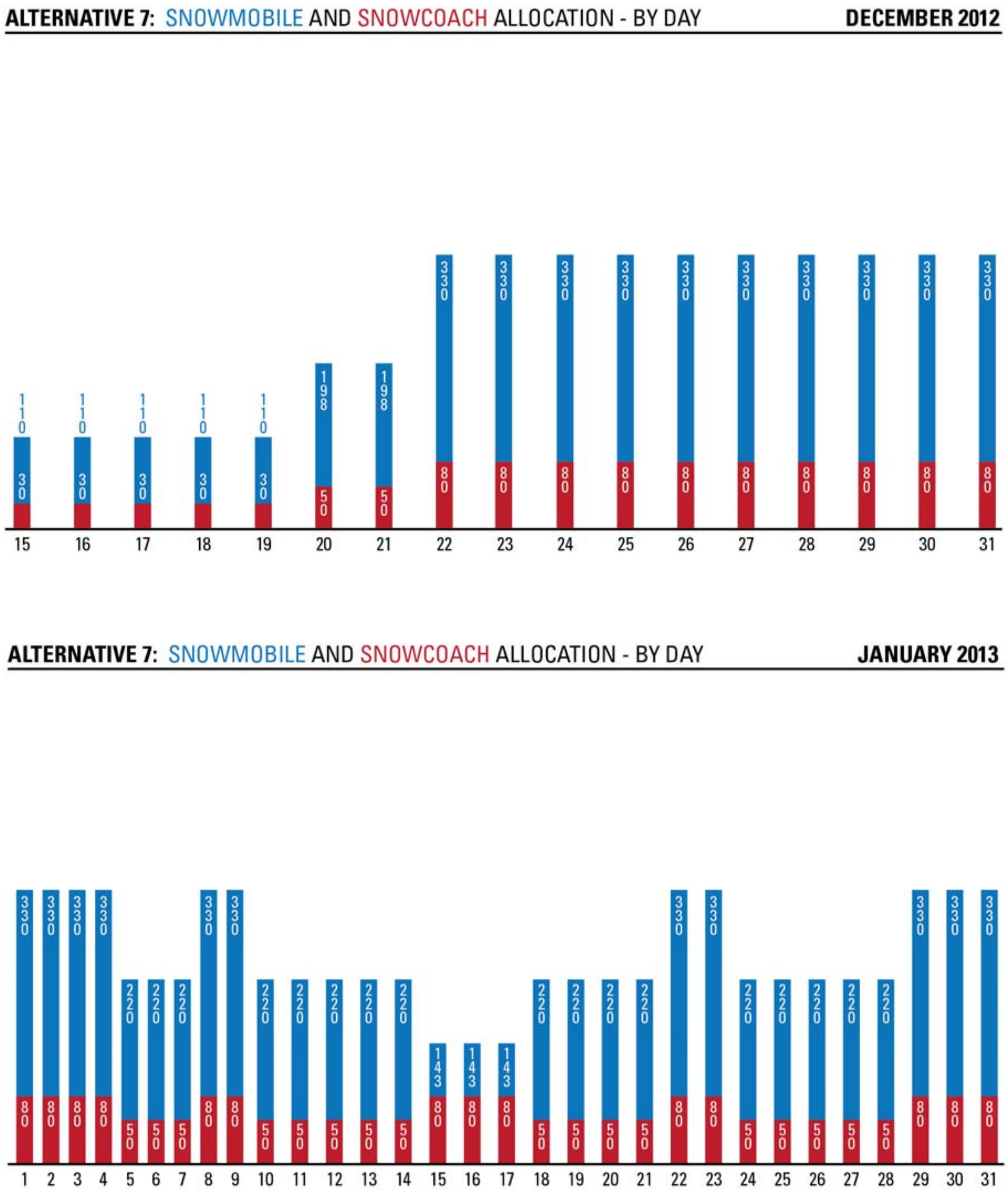
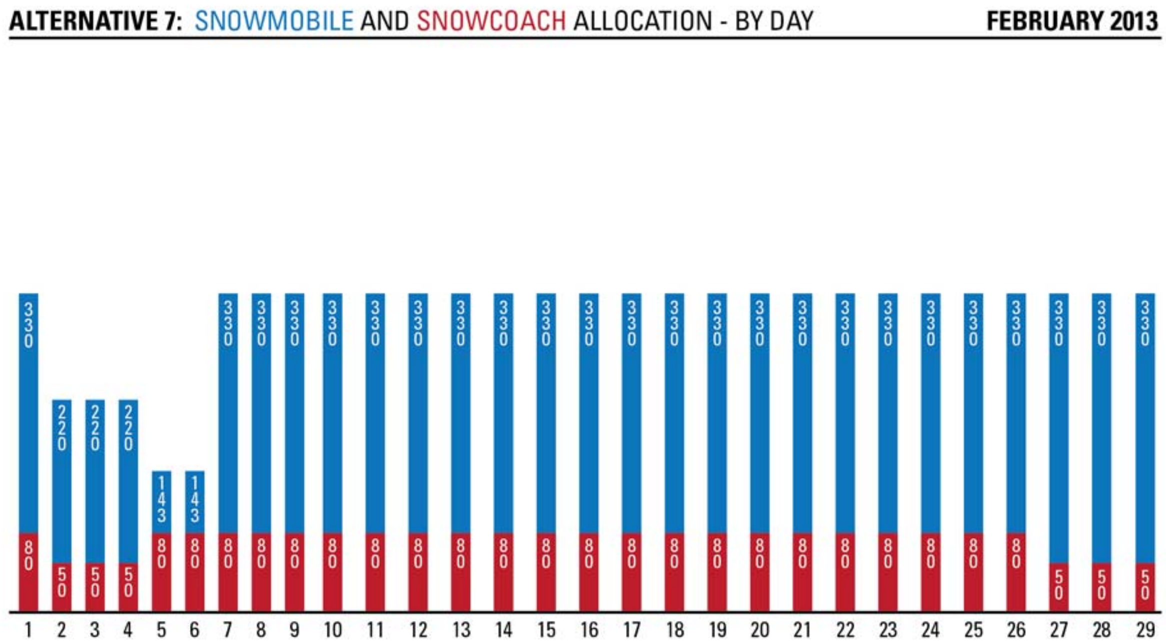


FIGURE 6: EXAMPLE SCHEDULE OF SNOWMOBILE AND SNOWCOACH USE VARIATION IN A SEASON UNDER ALTERNATIVE 7



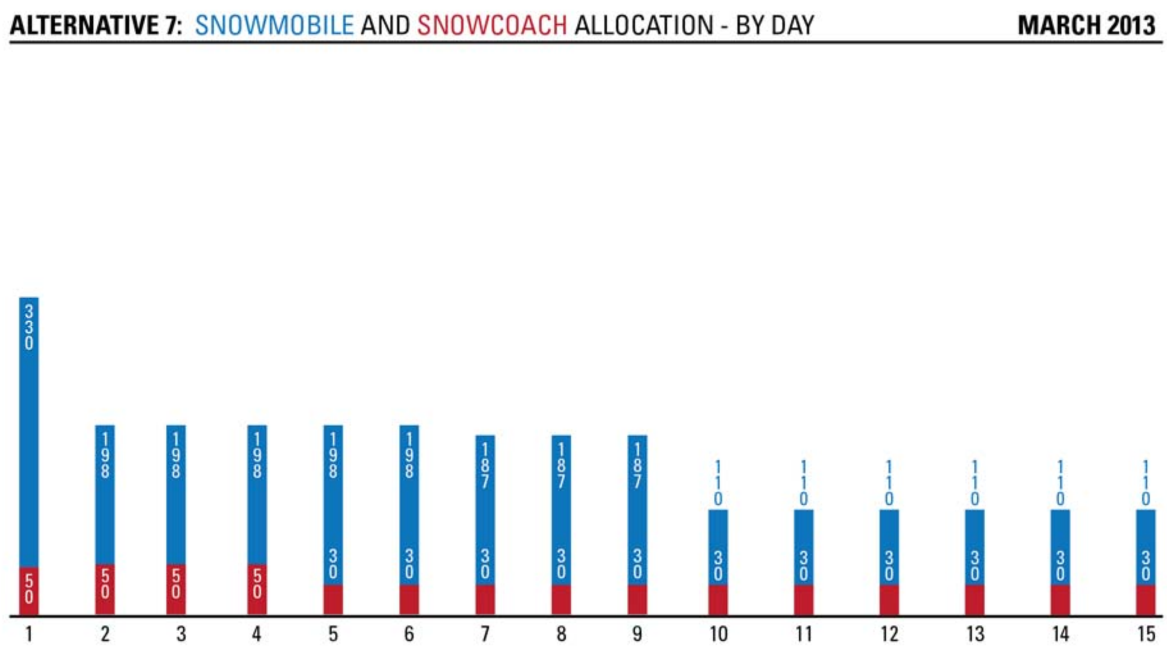


FIGURE 6: EXAMPLE SCHEDULE OF SNOWMOBILE AND SNOWCOACH USE VARIATION IN A SEASON UNDER ALTERNATIVE 7 (CONTINUED)

Under alternative 7, snowmobiles entering the park would follow current BAT requirements. Additional BAT standards for NO_x would be implemented for the 2014/2015 winter season. The NO_x BAT requirement would be that the sum of HC and NO_x would not exceed 15 grams per kilowatt-hour. Updated SAE standards for sound testing methodology, using the current version of SAE J192, would also be implemented for the 2014/2015 winter season[1]. The implementation of additional BAT requirements would be considered as technology improves, including hybrid and electric vehicles, among other improvements. An increased allocation of permits would be considered for companies using vehicles with such improvements.

Routes available to snowmobile use would be the same as those under alternative 6. The following presents a summary of the three use levels that would be implemented throughout the winter season under alternative 7 (also see table 8):

- For half of the winter season (or 45 days), up to 330 snowmobiles per day maximum would be permitted in the park.
- For one-third of the winter season (or 30 days), up to 220 snowmobiles per day would be permitted in the park.
- For one-sixth of the winter season (or 16 days), up to 110 or up to 143 snowmobiles per day would be permitted in the park.

TABLE 8: YELLOWSTONE DAILY SNOWMOBILE ENTRY LIMITS UNDER ALTERNATIVE 7

Entrance	Commercially Guided Snowmobiles
Up to 330 Snowmobiles Per Day for Half of the Winter Season	
West Entrance	176
South Entrance	110
East Entrance	22
North Entrance	11
Old Faithful	11
Up to 220 Snowmobiles Per Day for One-Third of the Winter Season	
West Entrance	110
South Entrance	66
East Entrance	0–22 (Closed Dec. 15–21 and March 2–15)
North Entrance	11
Old Faithful	11
Up to either 110 or 143 Snowmobiles Per Day for One-Sixth of the Winter Season	
West Entrance	66
South Entrance	44
East Entrance	0–11 (Closed Dec. 15–21 and March 2–15)
North Entrance	0–11 (Closed for Early Spring Plowing)
Old Faithful	0–11

[1] Under this alternative there would no longer be a barometric pressure variance.

Snowcoach Management. Similar to snowmobiles, the maximum number of snowcoaches permitted in the park would be separated into four subsets of allowed use throughout the season, each subset allocated between the different entrances. An average of 63 snowcoaches would be allowed to operate in the park per day for a total of 5,730 per season should the maximum capacity be reached each day throughout the winter season.

As described under snowmobile management, snowcoach levels would be based on a pre-determined seasonal schedule, which would be announced one year in advance and daily entrance allocations for groups would be flexible (see figure 6). Similar to other action alternatives, all snowcoaches operating in the park would be required to operate in accordance with a concessions contract. Private snowcoaches would not be permitted and fees for snowcoach use through commercial operators would continue.

BAT would be implemented for the 2014/2015 winter season, similar to other action alternatives. Snowcoach BAT requirements would include snowcoaches meeting Model Year 2010 gasoline or diesel EPA emission standards and not to exceed 73 dBA when operating at or near full speed for the 2014/2015 winter season.

The following presents a summary of the three use subsets that would be implemented under alternative 7. This information is summarized in table 9.

- For half of the winter season (or 45 days), up to 80 snowcoaches per day maximum would be permitted in the park.
- For one-third of the winter season (or 30 days), up to 50 snowcoaches per day maximum would be permitted in the park.
- For one-sixth of the winter season (or 16 days), either up to 30 or up to 80 snowcoaches per day maximum would be permitted in the park.

Wheeled Vehicle Management. Under alternative 7, wheeled vehicle access would continue as described under "Elements Common to All Alternatives."

Non-Motorized Use Management. Non-motorized use would be managed as described under "Elements Common to All Alternatives" except in addition, certain side roads would become ski and snowshoe routes at certain times of the season, and during these times OSVs would not be permitted in these areas to allow for a more solitude experience. These ski-snowshoe only side roads could include Firehole Canyon Drive, North Canyon Rim Drive, Riverside Drive, Fountain Flat Road, Firehole Lake Drive, Grand Loop Road – from Canyon Junction to the Washburn Hot Springs Overlook, and Virginia Cascades.

For the last two weeks of the winter season from March 2 through 15, OSV use would end at the West Thumb Parking Area and at the South Canyon Rim Drive in order to accommodate additional non-motorized snow recreational use on the east side of the park.

TABLE 9: YELLOWSTONE DAILY SNOWCOACH ENTRY LIMITS UNDER ALTERNATIVE 7

Entrance	Snowcoaches
Up to 80 Snowcoaches Per Day for Half of the Winter Season	
West Entrance	36
South Entrance	14
East Entrance	2
North Entrance	12
Old Faithful	16
Up to 50 Snowcoaches Per Day for One-Third of the Winter Season	
West Entrance	22
South Entrance	8
East Entrance	0–2 (closed December 15–21 and March 2–15)
North Entrance	8
Old Faithful	10
Up to 30 Snowcoaches Per Day for One-Sixth of the Winter Season – Allocation 1	
West Entrance	12
South Entrance	6
East Entrance	0 (closed December 15–21 and March 2–15)
North Entrance	6
Old Faithful	6
Up to 80 Snowcoaches Per Day for One-Sixth of the Winter Season – Allocation 2	
West Entrance	35
South Entrance	14
East Entrance	2
North Entrance	12
Old Faithful	16

Dates of Operation and Transition to New Plan. Under alternative 7, there would be no change in the dates for either motorized or non-motorized winter use in the park; the winter season would run from December 15 through March 15. OSV use would not begin until snow conditions permit.

Operating hours under alternative 7 would be from 6:00 a.m. to 9:00 p.m. However, the east entrance would open at 8:00 a.m. rather than 6:00 a.m. The entrance would also close at 9:00 p.m. Under alternative 7, all OSVs must enter the park by 10:30 a.m.

A one-season transition period to prepare for the implementation of the new winter-use plan would be put in place. Provisions of the 2009 interim rule would continue during this transition.

HOW ALTERNATIVES MEET OBJECTIVES

As stated in chapter 1 of this document, all action alternatives selected for analysis must meet all objectives to a large degree. The action alternatives must also address the stated purpose of taking action and resolve the need for action; therefore, the alternatives were individually assessed in light of how well they would meet the objectives for this draft plan/EIS, which are stated in chapter 1 of this document. Alternatives that did not meet the objectives were not analyzed further (see the "Alternative Elements Considered but Dismissed from Further Consideration" section in this chapter).

Table 10 is a summary of alternative elements. Table 11 compares how each of the alternatives described in this chapter would meet the plan objectives. Chapter 4 of this document describes the effects of each alternative on each impact topic. These impacts are summarized in table 12. Tables 10–12 are included at the end of this chapter.

ALTERNATIVES AND ACTIONS CONSIDERED BUT DISMISSED FROM FURTHER CONSIDERATION

Comments received during scoping for this draft plan/EIS, at meetings and open houses associated with planning included suggestions for alternatives or actions within alternatives. For various reasons, some of these alternatives or actions were eliminated from further study. Those alternatives and actions dismissed from further consideration did not meet the definition of a reasonable alternative, as stated by the CEQ. The CEQ states that, "Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant." In addition, they also meet project objectives, resolve need, and alleviate potentially significant impacts to important resources. An alternative is not automatically rendered unreasonable if it requires the amending of a park plan or policy; causes a potential conflict with local, state, or federal law; or lies outside the scope of what Congress has approved or funded or outside the legal jurisdiction of the NPS. The rationales for dismissing them are presented here.

ESTABLISH A MONORAIL SYSTEM IN YELLOWSTONE

Constructing a monorail in Yellowstone would be prohibitively expensive, particularly given Yellowstone's seismically active nature, unstable thermal ground, harsh weather, and remoteness. A 1994 study, for example, estimated the cost of building a 16-mile monorail through Hayden Valley at $880 million (BRW Inc. 1994). Ongoing maintenance costs would be exorbitant in Yellowstone's harsh climate. Many of these costs would have to be passed on to the visitor, which would dramatically increase the cost of a Yellowstone visit, making it unaffordable for many. Further, the visitor experience would be substantially altered, because a monorail could only stop and discharge passengers at fixed locations (unlike snowcoaches, buses, or automobiles, which may stop almost anywhere), and the monorail would physically distance visitors from the natural world much more than any other mode of transportation. Additionally, even though such a monorail would presumably be constructed on or near existing roadways, its intrusion upon the landscape would be far greater than that of contemporary roadways and traffic in the park (BRW Inc. 1994). Such limitations of the visitor experience and visual intrusions would not meet the objectives set out in this draft plan/EIS. Finally, it is uncertain whether wildlife would learn to pass under the monorail system. If they did not, one of the needs for this draft plan/EIS would not be addressed. Because of the factors above, and following CEQ guidance on reasonable alternatives, the concept of constructing a monorail in Yellowstone was not carried forward in this winter use plan. A monorail would be unreasonably expensive; implementing such a system would not meet park mandates to protect wildlife and visual quality (which would also be inconsistent with park statements of purpose and significance); and the construction and operation of a monorail system could impact park resources.

REVISE BAT REQUIREMENTS FOR SNOWMOBILES TO BE LESS RESTRICTIVE (FOR EXAMPLE ADOPT EPA STANDARDS)

Currently Yellowstone snowmobile standards are more stringent than EPA standards. If the current standards were revised to meet EPA regulations, less protective measures would be in place. BAT requirements for Yellowstone allow for hydrocarbon level of 15 grams per kilowatt hour (g/kW-hr), but EPA requirements allow for 75 g/kW-hr. Likewise, for carbon monoxide, the NPS BAT requirements call for 120 g/kW-hr, but the EPA requirements allow for 275 g/kw-hr. In both cases, the EPA requirements are more than double, and in the case of hydrocarbons five times more, than the NPS requirements. With limits increased to twice, or more, than currently permitted, impacts to air quality and visibility in the park would be expected to increase. Additionally, as stated under Section 1.8 of the NPS *Management Policies 2006*, the NPS “has an obligation to demonstrate and work with others to promote leadership in environmental stewardship.” The NPS believes that setting BAT requirements above EPA standards (and not allowing lower standards) is consistent with this policy and meets the plan objectives to promote improvements in technologies for winter use. This alternative was dismissed because the anticipated impacts would not meet the objectives of this plan, as well as NPS policies.

ALLOW USE OF PERSONAL VEHICLES ON PLOWED ROADS

The idea of plowing Yellowstone’s roads in winter was first suggested in 1932 and has been debated numerous times since then. Visitor and employee safety is a concern; winter road traveling conditions can be far more hazardous due to severe expected and unexpected storms and fast changing conditions. Private vehicles may lack the necessary equipment needed in case of emergency. Plowed roads would require a higher level of emergency response for accidents. Response time would depend on road and weather conditions, making it difficult and unsafe for emergency situations. Also, a higher level of road maintenance would be required. For these reasons, the element of plowing park roads for private vehicle use would not meet the purpose, need, and objectives of this plan and was dismissed from further analysis; however, the range of alternatives does address the request to analyze wheeled vehicle access by providing for plowing. Use of commercial vehicles would allow the park to better manage this use and provide for a safer visitor experience.

OPTIONS FOR MANAGEMENT OF COLTER PASS TO THE EAST OF COOKE CITY, MONTANA (US-212)

The road between Colter Pass and Cooke City, Montana, is outside of Yellowstone. Because the NPS does not own the roadbed, the park does not have management authority over its operation. Therefore, this alternative is outside of the scope of this draft plan/EIS, which is to manage winter use within Yellowstone.

ALLOW SNOWBIKES AND KITE-SKIING (AND OTHER USES)

Snowbikes are modified bicycles with large, low-pressure tires to facilitate use on groomed routes. Kite-skiing is similar to kite-surfing with the exception of using the surface snow and using snow skis. Kite-skiing in the park is currently prohibited under the 2010 Superintendent’s Compendium (February 9, 2010) (url: http://www.nps.gov/yell/planyourvisit/upload/supt_compendium.pdf). The NPS believes that the use of snowbikes and kite-skiing could conflict with and/or create safety hazards along routes on which substantial numbers of snowmobiles and snowcoaches operate, such as the groomed roads in Yellowstone, which would not meet the health and safety objectives of this draft plan/EIS. These uses may also create potential conflict with park resources, and would not meet natural resource objectives. Within units of the national park system, bicycles may only be used on park roads, parking areas, and on routes designated for such use by special regulation. Additionally, this alternative is outside the scope of this draft plan/EIS as it does not meet the purpose of managing motorized use. Similarly, due to impacts on park resources and safety concerns, dog sledding, ski-joring, and snowplanes are prohibited and outside the scope of this draft plan/EIS.

Remove Limits to OSV Use and Eliminate BAT Requirements (Return to 1983 Regulations/"Pre-Managed Era")

The 1983 regulations describe a type and amount of snowmobile use that was analyzed in the 2000 winter use plan and found to constitute impairment of park resources and values in the 2000 Record of Decision and the 2003 SEIS. Specifically, as stated in the record of decision for the 2003 SEIS, snowmobile use at 1983 levels would result in impairment from the "impacts from snowmobile use on air quality, wildlife, the natural soundscape, and opportunities for enjoyment of the park by visitors" (NPS 2003c, 2003d). The potential impairment under this level and type of use would result in the park not meeting the objectives for this draft plan/EIS related to resources (wildlife, sound, air quality, wilderness), may not be legally permissible and thus does not meet the purpose, need, and objective's criteria for in this draft plan/EIS. This alternative would not meet park mandates or objectives for management; therefore, this alternative was dismissed from further analysis.

Open the Park During Spring/Fall Seasons

Although Yellowstone is open year round, access is restricted to certain parts of the park for portions of the year, such as the interior. The current winter season dates to access the interior of the park are December 15 to March 15. The park temporarily closes the west, east, and south entrances from early-November through December 15, and March 15 through mid-April. The road from Mammoth to Cooke City remains open all year round. During the spring and fall seasons, park staff plows and clears snow from the roads to make them accessible for private vehicle use. Opening the park during the spring and fall seasons would not allow for an adequate transition time between seasons for snow removal and therefore was dismissed because this alternative would not be able to be implemented due to logistical constraints. Additionally, this element is outside the scope of this draft plan/EIS, which is for the "winter" season: mid-December to mid-March.

Designate an Area for Off-trail or Extreme Snowmobiling

Off-road vehicle use in national parks, including the use of OSVs, is permitted under Executive Order 11644 (including the amendments in Executive Order 11989), and its implementing regulations. This Executive Order states that in order to have off-road vehicle use, parks must designate specific areas and trails on which the use of off-road vehicles may be permitted, and areas in which the use of off-road vehicles may not be permitted. Designation of such areas and trails will be based upon the protection of the resources of the public lands, promotion of the safety of all users of those lands, and minimization of conflicts among the various uses of those lands. Trails for off-road use are not designated in Yellowstone, and therefore this use (OSV use outside of the existing roadway) would not be permissible. Because this element is not legally permissible, it does not meet the purpose of this draft plan/EIS. The NPS does not have management authority outside of national parks and many off-trail areas already exist in other areas near national parks. Additionally, use of an OSV that is off-trail or unguided would result in greater disturbance to park wildlife. Before the implementation of mandatory guiding, conflicts between OSV users and wildlife were common (Dimmick 2003). Rangers were frequently dispatched to the scene of wildlife/visitor conflicts to direct traffic and ensure the safety of both visitors and wildlife. OSV users cited for off-road violations often stated that they were attempting to evade or go around bison (Dimmick 2002, 2003; NPS 2008a). Implementation of mandatory guiding has substantially reduced wildlife/visitor conflicts. Areas where use is not guided, such as an extreme snowmobiling of off-trail area, would therefore result in greater disturbances to wildlife. Because of the factors above, and following CEQ guidance on reasonable alternatives, the concept of designating an area for off-trail or extreme snowmobiling was not carried forward in this winter use plan because it does not meet the purpose of the plan. Creating such an area would not meet park mandates to protect wildlife (which would also be inconsistent with park statements of purpose and significance), and operation of such an area could impact park resources.

MANAGE/LIMIT OSV USE ON A DAILY BASIS, BASED ON WEATHER AND OTHER RESOURCE CONDITIONS

Managing or limiting OSV use on a daily basis, according to weather and other resource conditions, could cause a high level of uncertainty for visitors, park staff, and concessioners and would make this alternative difficult to implement logistically. Due to the high level of uncertainty of daily decisions of park opening/closing and the logistical challenges, this element was not carried through for this draft plan/EIS. However, the idea of flexible management was considered in alternatives 6 and 7, which would provide variation based on a schedule set one full year in advance.

CLOSURE OR OTHER ADDITIONAL MANAGEMENT FOR THE NORTH TO NORTHEAST ENTRANCE ROAD

Winter use activities occur throughout the park, including along the north to northeast entrance road. Visitors can traverse this road to access Cooke City, or to experience the park resources, including wildlife viewing in Lamar Valley. During public scoping, the winter management of this road, specifically if the road was open or closed, was not raised as an issue of concern. Commenters noted that the current policy that allows private vehicles on the road between Mammoth and the northeast entrance could be reconsidered, and suggested a scenario where commercial busses only would be allowed on this road (with only legal residents of Silver Gate and Cooke City allowed private vehicle access). How the north to northeast entrance road functions in the winter is beyond the scope of this plan, as it relates to the regional transportation network, rather than winter use in the interior of the park. The purpose of the winter use plan is to assess management of use in the interior of the park. The interior is defined as is those areas in Yellowstone that have been traditionally accessible via OSVs only in the winter. It includes developed areas such as Old Faithful, Madison, Canyon, Lake, Grant Village, and the entrance and connecting roads. Management of the north to northeast entrance road is outside the scope of this planning effort.

CONSISTENCY WITH THE PURPOSES OF NEPA

The NPS requirements for implementing NEPA include an analysis of how each alternative meets or achieves the purposes of NEPA, as stated in sections 101(b) and 102(1). CEQ Regulation 1500.2 establishes policy for federal agencies' implementation of NEPA. Federal agencies shall, to the fullest extent possible, interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in NEPA (sections 101(b) and 102(1)); therefore, other acts and NPS policies are referenced as applicable in the following discussion.

1. **Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.**

   All of the alternatives proposed would manage OSV use in a manner to best protect the resources, but the degree to which they accomplish this goal would vary. Alternative 1 would meet the four resource related objectives (wildlife, soundscapes, air, and wilderness) to a large degree because visitor OSV use would no longer be permitted within the interior of Yellowstone. The absence of visitor OSV use would result in a near absence of air and sound emissions, as well as disturbance to wildlife. Alternative 1 would fully meet the purpose of fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations, by providing most of the interior of the park free of air and noise emissions, as well as wildlife disturbance, during the harsh winter conditions.

Alternatives 2, 4, 5 and 7 would allow OSV use in the park, but at levels that are near or below current use levels. Wildlife, air, and sound monitoring, as well as modeling conducted for this draft plan/EIS, has shown that although impacts to these resources would occur, they would be well below any regulatory standard and within NPS Management Policies. Monitoring and modeling has also shown that these OSV use levels could occur, and the resources would be preserved for succeeding generations. These alternatives, as well as all of the action alternatives, would include OSV management measures such as commercially guided OSV use, BAT snowmobiles, and the conversion to BAT snowcoaches, which would further act to preserve park resources. Alternative 7 would include the additional requirement for the BAT standard for NO_x. Therefore, alternatives 2, 4, 5, and 7 would meet this purpose to a large degree but not fully because of greater potential for impacts to park resources during the winter, because some level of OSV use would be allowed.

Alternatives 3 and 6, which would allow use levels higher than current conditions, have the greatest potential to create impact to park resources and would only meet this purpose to a moderate degree. Although OSV management protections would be in place, the higher level of OSV use would have a greater potential to disturb wildlife during a time when they are most susceptible to disturbance, and would have greater impacts on the soundscape. Further, the provision for unguided or non-commercially guided use under alternative 6 could result in a higher level of noncompliance with OSV management measures, because there would not be a commercial guide with the group to ensure all management measures are being followed. The potential for a higher level of noncompliance could also result in a higher level of disturbance to park resources and impact the ability for enjoyment by future generations.

2. **Ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.**

All alternatives meet this purpose to some degree because the park is a safe visitor destination that is both esthetically and culturally pleasing. The action alternatives (alternatives 2, 3, 4, 5, 6, and 7) increase safety to a degree by requiring OSV users in the park to travel with a commercial guide who has been trained in addressing fast changing winter conditions, who has the equipment to quickly communicate with the park and others in case of an emergency, and who is required to carry emergency equipment. These alternatives also require BAT for snowmobiles and the development of BAT for snowcoaches, which would reduce air and noise emissions that can be hazardous to employee and visitor health. However, for alternatives 2, 3, 5, 6, and 7, the opening of Sylvan Pass would require NPS to conduct avalanche control activities in this area. There are inherent risks to operating in an active avalanche area, and for this reason, these alternatives would only meet this purpose to some degree. Alternative 4 would include the same OSV management measures as the other action alternatives, but Sylvan Pass would be closed to OSV use and the NPS would not be required to conduct avalanche control operations in that area. Because this risk would be reduced, alternative 4 would meet this purpose to a large degree.

Alternative 1 would, on the whole, reduce risks associated with OSV use, even OSV use that is managed such as in the case in Yellowstone. Whereas these risks would be reduced, non-motorized users in the interior of the park would face risks from the absence of OSV or other park facilities to assist in case of emergency. Although there would be some risks to non-motorized users, this use, especially in the interior of the park, is expected to be low, therefore alternative 1 meets this purpose to a large degree.

3. **Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.**

   All of the action alternatives offer a wide range of visitor use opportunities, including snowmobile use (which could be phased out under alternative 5) and snowcoach use. However, the type and diversity of winter use allowed under a particular alternative could provide for a different way for visitors to experience the park, or lead to resource degradation or risks to health and safety with higher levels of use. Alternative 2 allows for levels of use that are similar to current levels, which would provide for a variety of uses and resource protection. Based on monitoring results of current use levels, visitors would have various opportunities for use and resources would still be offered protection. Alternative 3 would allow for the same types of use as alternative 2, but at higher use levels. Due to the potential for higher use levels to impact park resources, this alternative would meet this purpose to a moderate degree. Alternative 4 would introduce commercially guided wheeled vehicles into the interior of the park while still allowing for OSV use. This new use would allow for a different visitor experience and, due to its expected lower cost than OSV use, may open up the winter experience at Yellowstone to more and different users. Because this alternative would provide a wider range of visitor experiences and protect park resources, it would meet this purpose to a large degree. Alternative 5 could reduce overall OSV use to 120 snowcoaches by the end of the five-year transition period. The lower level of OSV use would result in less disturbance to resources, but because alternative 5 would remove existing visitor use opportunities, it would only meet this purpose to a moderate degree. Alternative 6 would allow for variable use levels to accommodate high demand times, as well as providing for different use experiences (OSV or non-motorized) throughout the winter season. This alternative would also provide for up to 25% unguided or non-commercially guided use, a visitor experience that has been mentioned by the public during public scoping for this winter use planning process and during past winter use planning processes. Although there would be a greater potential to disturb resources on high use days, this alternative would include low use days (which could be zero), which would offer times of less disturbance. Because of the range of experiences offered under alternative 6, this alternative meets the purpose to a large degree. Alternative 7, like alternative 6, would allow for variable use levels to accommodate high demand times, as well as providing for different use experiences (OSV or non-motorized) throughout the winter season. However, use levels would be lower than alternative 6 and would be similar to or lower than alternative 2. Although there may be fewer winter use opportunities under alternative 7, it is expected that this level would meet user demand and better preserve the resources that make up the visitor experience, and therefore fully meet this purpose.

   Alternative 1 would allow for non-motorized use within the park, but would not allow for visitor OSV use in the interior of the park. Due to the distance and harsh weather conditions, many visitors would not be able to reach the interior of Yellowstone, and features like Old Faithful, without the use of OSV; therefore, alternative 1 meets this purpose to only some degree.

4. **Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.**

   Because none of the alternatives would result in impacts to cultural or historic resources that would exceed minor, these topics were dismissed from further analysis in this draft plan/EIS. Overall, because any impacts to cultural or historic resources would not exceed minor, all alternatives would preserve important historic and cultural aspects of our national heritage in the long-term and would meet this purpose to a large degree. Alternatives that provide for lower OSV use levels (alternatives 1, 2, 4, 5, and 7) would meet this purpose for natural resources to a larger degree than alternatives 3 and 6, as discussed under criteria 1 and 2. As discussed under criteria 3, alternatives 4, 6, and 7 would best support diversity and variety of individual choice (to a large degree) because of the multiple options provided for experiencing the park in the winter. Alternatives 2, 3, and 5 (meeting the purpose to a moderate degree) would provide some access to the park, including OSV access, but would not offer as great a variety of uses as alternatives 4, 6, and 7. Alternative 1 (meeting the criteria to some degree) would limit the variety of choice by discontinuing visitor OSV use in the interior of the park.

5. **Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.**

   Balancing population and resource use under this draft plan/EIS would include protecting the resources unimpaired for the enjoyment of present and future generations and providing access for visitors to experience the natural resources of the park. NPS *Management Policies 2006* states that the enjoyment contemplated by the Organic Act is broad; it is the enjoyment of all the people of the United States and includes enjoyment both by people who visit parks and by those who appreciate them from afar. It also includes deriving benefit (including scientific knowledge) and inspiration from parks, as well as other forms of enjoyment and inspiration. Congress, recognizing that the enjoyment by future generations of the national parks can be ensured only if the superb quality of park resources and values is left unimpaired, has provided that when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant. For all alternatives, except alternative 1, visitors would continue to have opportunities to enjoy from afar through programs such as the Old Faithful webcam, and well as information and literature posted on-line. Under alternative 1, the extremely limited staff at Old Faithful would not be maintaining equipment such as the webcam in the winter. As discussed above, alternatives 2, 4, 5, and 7 would provide for OSV use in the park, with management measures (BAT for all OSV and guiding requirements) and use levels (at or below current levels) that would provide a level of protection to park resources to allow for their future enjoyment. Likewise, alternative 1, which would not allow for OSV use, would also protect park resources. Alternatives 1, 2, 4, 5, and 7 would fully meet this purpose. Alternatives 3 and 6, which allow for a higher level of OSV use, would meet the purpose to a large degree as the public would be provided access to the amenities in the park, including OSV use, but with higher use levels that may not offer the same level of protection to natural resources as the other alternatives.

6. **Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.**

   For reasons discussed above, in varying degrees the action alternatives (alternatives 2, 3, 4, 5, 6, and 7) would promote enhancing renewable resources because all alternatives require the use of BAT for snowmobiles and the development and implementation of BAT for snowcoaches. Alternative 6 also provides a greater level of encouragement than the other action alternatives. By using cleaner, more sustainable technologies OSV operators could obtain more use permits, and alternative 7 provides additional BAT requirements for NO_x. The second purpose, "approach the maximum attainable recycling of depletable resources," is less relevant to the development of this winter use plan because it relates to "green" building or management practices. There would be little construction related to any alternative, except alternative 4, so this purpose would not apply. Alternative 4 would involve the construction of support buildings for vehicle staging and equipment associated with road plowing. These buildings would be designed following all federal guidelines for sustainability.

As discussed in chapter 1 of this document, each of the alternatives would require the park to continue to operate under the wise energy use guidelines and requirements stated in the NPS *Management Policies 2006*; Executive Order 13123, Greening the Government through Effective Energy Management; Executive Order 13031, Federal Alternative Fueled Vehicle Leadership; Executive Order 13149, Greening the Government Through Federal Fleet and Transportation Efficiency; and the 1993 NPS Guiding Principles of Sustainable Design. Therefore each alternative would fully meet this purpose.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

The NPS is required to identify the environmentally preferable alternative in its NEPA documents for public review and comment. The NPS, in accordance with the Department of the Interior NEPA Regulations (43 CFR Part 46) and CEQ's Forty Questions, defines the environmentally preferable alternative (or alternatives) as the alternative that best promotes the national environmental policy expressed in NEPA (section 101(b)) (516 DM 4.10). The CEQ's Forty Questions (Q6a) further clarifies the identification of the environmentally preferable alternative stating, "this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources."

Alternative 1, the no-action alternative, was identified as the environmentally preferable alternative because public OSV use would no longer be permitted within the park. With winter use being limited to minimal administrative use of OSV, there would be the least amount of impact on the biological and physical environment within the park. As noted in table 11, the no-action alternative meets the objectives related to resources (wildlife, air, sound, and wilderness) to the greatest degree due to the lack of recreational OSV use. By best meeting these objectives, the no-action alternative would cause the least amount of damage to the biological and physical environment. Although administrative OSV use and non-motorized use would occur, the use levels would be low and impacts to resources would be minimal. The no-action alternative does provide for minimal administrative use to "winter keep" structures in the interior of the park, therefore it would also protect and preserve the historic and cultural resources.

NATIONAL PARK SERVICE PREFERRED ALTERNATIVE

To identify the preferred alternative, each alternative was evaluated based on its ability to meet the plan objectives (see table 11) and their potential impacts on the environment (see chapter 4 of this document). An initial screening of the alternatives was accomplished by the project team through the Choosing By Advantages (CBA) process held November 8–10, 2010. The CBA process considered the advantages of the six alternatives that were presented to the public in August 2010, which are the same as alternatives 1–6 presented above. Each of the six alternatives were evaluated against three factors: resource protection, visitor use, and park operations and management. After the CBA process on these initial alternatives was complete, the project team took elements from each alternative that were found to have a high advantage, to create alternative 7. The discussion below evaluates all of the proposed alternatives against the objectives of this plan and details why alternative 7 was identified as the NPS preferred alternative.

Alternatives 2, 3, and 5 would meet the objectives on the whole, from a moderate to large degree, with some objectives being fully met. However, these alternatives would not meet the objectives as well as alternatives 4, 6, and 7 because they do not provide the same amount of variety in visitor experiences, due to the fact that daily use levels would be constant throughout the winter season. Alternative 3 would allow for higher use levels that would have greater impacts on winter resources, as described in chapter 4, and would therefore meet those resource-specific objectives to a lesser degree. Alternative 5 would meet objectives related to resources similar to other alternatives evaluated, but limiting the mode and number of visitors able to access the park during the winter season. Alternatives 2, 3, and 5 would not include additional BAT requirements that would promote advances in technology; however, alternatives 6 and 7 include these additional BAT requirements. Because alternatives 2, 3, and 5 would not meet the plan's objectives as well as other alternatives, they were not identified as the NPS preferred alternative.

Alternative 1 would meet the objectives, on the whole, to a moderate degree, but many objectives would be met to a small degree. By restricting access to the interior of the park in the winter to only administrative access, this alternative would not meet key objectives related to visitor use or providing critical visitor services. However, because of this limited use, alternative 1 would meet all resource related objectives to a large degree, better than any of the action alternatives evaluated. Also, similar to alternative 4, alternative 1 would meet objectives related to health and safety to a large degree due to the closure of Sylvan Pass and the reduction in risk to employees who would not work in that location during the winter. Other park operations objectives would not be met (related to encouraging improvements in technology) because visitor OSV use would not be permitted in the interior of the park. These objectives may be met to some degree (related to providing critical visitor services at core locations) because the interior of the park would not be accessible to the majority of visitors without motorized access. Because alternative 1 would not meet many objectives to the same degree as the action alternatives, it was not identified as the NPS preferred alternative.

Due to their similarity in providing additional modes of access or providing for flexible use days, alternatives 4, 6, and 7 meet the objectives, on the whole, to a moderate degree, with many objectives fully being met. In terms of visitor use, these three alternatives would provide the opportunity for visitors to experience and be inspired by Yellowstone's unique winter resources and values and would increase visitor understanding and appreciation of winter resources by allowing access into the park's interior by motorized means. These three alternatives meet visitor use objectives to a higher degree than the other alternatives that provide motorized winter access to visitors (alternatives 2, 3, and 5). Alternatives 4, 6, and 7 offer additional choices for accessing the park (such as the provision for wheeled vehicle access under alternative 4) or for a greater variety of winter experiences by varying the levels of OSV use and OSV free days throughout the winter season (alternatives 6 and 7), as well as providing for additional non-motorized use opportunities. Alternative 4 provides more opportunities for visitors with mobility challenges compared to all other alternatives evaluated, due to the addition of commercially guided wheeled vehicle access.

For all resource related objectives, alternatives 4 and 7 provide for a level of use that would result in minimal impacts to wildlife and allow for times of natural quiet. Under alternatives 4 and 7, air quality would be maintained below all regulatory standards, and these alternatives would have minimal impacts (specifically intrusion of noise) on adjacent wilderness areas as shown in the impact analysis in chapter 4. Alternative 6 would also meet air quality and wilderness objectives to a moderate degree. However, alternative 6 would not meet the objectives related to wildlife and sound (meeting both objectives to some degree) to the same degree as alternatives 4 and 7 because the higher levels of use permitted could result in more disruption to wildlife and would reduce the times of natural quiet in the park. Alternative 4 meets health and safety related objectives to a large degree due to the closure of Sylvan Pass which would eliminate the need for staff to work in this known avalanche area. Alternatives 6 and 7 meet this objective only to some degree, because operations at Sylvan Pass would continue. Alternatives 4, 6, and 7 (as well as all the other action alternatives) fully meet the objectives for coordination and cooperation and for development of an adaptive management plan. Because alternatives 4, 6, and 7 allow for motorized access into the park in the winter, they all meet the objective to provide critical visitor services at core locations to a large degree. Alternatives 6 and 7 meet objectives related to promoting advances of technology to a large degree because alternatives 6 and 7 include elements that either promote the development of new technologies through incentives to OSV providers (alternative 6) or require the development of new BAT standards for NO_x (alternative 7). Alternative 4 includes the same BAT requirements as all of the action alternatives, but does not include additional standards that promote technology, thus meeting this objective to only a moderate degree.

Because alternative 7 provides for a range of visitor experience opportunities through variable use days while maintaining OSV levels that would have minimal impacts on the park's winter resources, and provides for additional BAT development, the NPS determined that this alternative, on the whole, best meets the objectives of this plan. Although alternative 4 better meets health and safety objectives due to the closure of Sylvan Pass, current operational practices (described in chapters 3 and 4) would ensure that the pass would continue to operate in a manner that would minimize risk to NPS staff. Alternative 6 would offer many of the same benefits as alternative 7, but the higher use levels would have greater impacts to wildlife and soundscapes, and therefore it was not identified as the preferred alternative.

NPS will consider comments on this draft plan/EIS and may modify or adjust the preferred alternative accordingly. Any modifications or adjustments will be disclosed in the published final EIS. A Record of Decision will follow the final EIS and will be made available to the public.

TABLE 10: SUMMARY OF ALTERNATIVE ELEMENTS

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
General Description	Once the 2009 interim rule expired (after the 2010/2011 season) there would be no rule in place and OSV use would be no longer permitted. Administrative OSV use would continue as needed. Visitors could ski or snowshoe into the park.	OSV use would continue at levels described under the 2009 interim rule – up to 318 snowmobiles and up to 78 snowcoaches per day.	OSV levels in the park would return to the 2004 plan limits – up to 720 snowmobiles and 78 snowcoaches a day.	Access to the park would be by commercial wheeled vehicles (north and west entrances) and snowmobiles and snowcoach (south entrance) only. No private vehicles would be permitted. The east entrance would be closed to through travel for OSVs, but open for non-motorized use.	OSV access into the park could transition towards snowcoaches meeting BAT requirements. Snowcoaches could replace snowmobiles beginning in the 2014/2015 winter season, when all snowcoaches must meet BAT requirements. Snowcoaches could replace snowmobiles within a five-year period, depending on snowcoach use demand.	Management of winter use would be structured to increase the variety of winter experiences. OSV levels would vary by creating times and places for higher and lower levels of use. Additional opportunities for undisturbed skiing and snowshoeing would also be created.	Various use levels would establish a maximum number of snowmobiles and snowcoaches permitted in the park for specific days throughout the winter season. Four different use levels for each OSV type would be implemented; the combination of which may vary by day. Snowmobile use would range from 110 to 330 per day and snowcoach use would range from 30 to 80 per day.
Elements Related to Snowmobile Use							
Daily Snowmobile Limits (with allocations by entrance)	n/a	Up to 318 snowmobiles per day (Actual current average is about 187 per day). Entrance allocations: • West – 160 • South – 114 • East – 20 • North – 12 • Old Faithful – 12	Up to 720 snowmobiles per day. Entrance allocations: • West – 414 • South – 246 • East – 20 • North – 20 • Old Faithful – 20	Up to 110 snowmobiles per day. Entrance allocations: • South – 66 • Old Faithful – 22 • Norris – 22	Up to 318 snowmobiles per day through 2014/2015 winter season. Initial entrance allocations are the same as alternative 2. Gradual reduction to zero snowmobiles would occur after the 2014/2015 season, as BAT snowcoach numbers increase (see “Elements Related to Snowcoaches,” below). As parkwide snowmobile numbers are reduced, entrance allocations would be reduced proportionally.	32,000 snowmobiles would be permitted each season. Daily numbers could vary between 0 and 540.	Up to 330 snowmobiles per day maximum for one-half of the winter season (45 days) Entrance allocations: • West: 176 • South: 110 • East: 22 • North: 11 • Old Faithful: 11 Up to 220 per day maximum for one-third of winter season (30 days) Entrance allocations: • West: 110 • South: 66 • East: 0 to 22 (East closed Dec. 15–21 and March 2–15) • North: 11 (1 group) • Old Faithful: 11 (1 group) Between 110 and 143 per day maximum for one-sixth of winter season (16 days) Entrance allocations: • West: 66 • South: 44 • East: 0–11 (East closed Dec. 15–21 and March 2-15) • North: 0 – 11 (North closed early for spring plowing) • Old Faithful: 0 – 11
Variable snowmobile numbers	n/a	Daily snowmobile levels would be fixed for the season. No variation would occur.	Daily snowmobile levels would be fixed for the season, with no variation.	Daily snowmobile levels would be fixed for the season, with no variation.	Daily snowmobile levels would be fixed for the season, with no variation.	Snowmobile levels would vary (daily, weekly or monthly) based on a pre-determined seasonal schedule.	Snowmobile levels would vary (daily, weekly, or monthly) based on a pre-determined seasonal schedule. The schedule would provide low and high use opportunities during holiday and non-holiday periods.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Variable entrance allocations	n/a	Entrance allocations would be fixed (may not be shared between entrances).	Entrance allocations would be fixed (no sharing between entrances).	Entrance allocation could be flexible, based on the demand at the three snowmobile entrance locations (sharing allowable among South, Norris, and Old Faithful).	Allocation of snowmobiles by entrance could be flexible, based on demand (i.e., sharing among West, South, East, North, and Old Faithful).	Daily entrance allocation for commercially guided groups could be flexible, to provide and accommodate a variety of winter experiences. For example, daily allocations not used at one gate could be used at another gate that same day.	Allocation of snowmobiles by entrance could be flexible, based on demand (i.e., sharing among West, South, East, North, and Old Faithful).
Snowmobile Guide Requirements, including maximum group size (if applicable)	n/a	100 percent commercially guided. Group size (including guide):11	100 percent commercially guided. Group size (including guide):11	100 percent commercially guided. Group size (including guide):11	100 percent commercially guided. Group size (including guide):11	Mostly guided, with up to 25 percent of snowmobile use unguided or non-commercially guided. Group size (including guides): Maximum group sizes may vary between 11 and 22 snowmobiles. Groups up to 11 would have one guide, between 12 and 22 would have two guides.	100 percent commercially guided. Group size (including guide):11
BAT Requirements for Snowmobiles	n/a	BAT required for snowmobiles.	BAT required for snowmobiles.	BAT required for snowmobiles.	BAT required for snowmobiles.	BAT required for snowmobiles. As this technology improves (hybrid, electric, etc.), consider additional permits for those companies that use them.	Develop additional BAT standard for NO_x, to be implemented by 2014/2015 winter. Proposal: Sum of NO_x and HC not to exceed 15 g/kW-hr. Adopt updated SAE sound testing methodology by 2014/2015 (the barometric pressure variance would no longer apply). As technology improves (hybrid, electric, etc.), consider additional permits for those companies that use them.
Fee for snowmobile use	n/a	Yes	Yes	Yes	Yes	Current fees for snowmobile use and commercial operators would continue. A comparable special use fee may be charged for non-guided/non-commercially guided snowmobile use to manage that use.	Yes

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Elements Related to Snowcoach Use							
Daily Snowcoach Limits (with allocations by entrance)	n/a	Up to 78 snowcoaches per day. Entrance allocations: • West – 34 • South – 13 • North – 13 • East – 2 • Old Faithful – 16	Up to 78 snowcoaches per day through 2014. Entrance allocations: • West – 34 • South – 13 • North – 13 • East – 2 • Old Faithful – 16	Up to 30 snowcoaches per day. Entrance allocations: • South – 20 • Old Faithful – 8 • Norris – 2	Up to 78 snowcoaches per day initially, allocated by entrance the same as in alternative 2. As of 2014/1015, increase to up to 120 BAT snowcoaches per day (with a corresponding decrease in snowmobiles over a five-year period as snowcoach numbers increase). As the number of snowcoaches throughout the park increases, their allocation by entrance would rise proportionally.	4,600 snowcoaches would be permitted per season. Daily use limits would vary between 0 and 78.	Up to 80 snowcoaches per day maximum for one-half of winter season (45 days) Entrance allocations: • West: 36 • South: 14 • East: 2 • North: 12 • Old Faithful: 16 Up to 50 snowcoaches per day maximum for one-third of winter season (30 days) Entrance allocations: • West: 22 • South: 8 • East: 0 to 2 (East closed Dec. 15–21 and March 2–15) • North: 8 • Old Faithful: 10 Between 30 and 80 snowcoaches per day maximum for one-sixth of winter season (16 days) under one of two entrance allocations Allocation 1: • West: 12 • South: 6 • East: 0 (East closed Dec. 15–21 and March 2–15) • North: 6 (North closed early for spring plowing) • Old Faithful: 6 Allocation 2: • West: 36 • South: 14 • East: 2 • North: 12 • Old Faithful: 16
Variable snowcoach numbers	n/a	Daily snowcoach levels would be fixed for the season. No variation would occur.	Daily snowcoach levels would be fixed for the season. No variation would occur.	Daily snowcoach levels would be fixed for the season. No variation would occur.	Daily snowcoach levels would be fixed for the season. No variation would occur.	Snowcoach levels would vary (daily, weekly or monthly) based on a pre-determined seasonal schedule.	Snowcoach levels would vary (daily, weekly or monthly) based on a pre-determined seasonal schedule.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Variable entrance allocations	n/a	Entrance allocations would be fixed (may not be shared between entrances).	Entrance allocations would be fixed (may not be shared between entrances).	Entrance allocation would be flexible, based on the demand at the three snowcoach entry locations (i.e., sharing among South, Norris, and Old Faithful).	Entrance allocation would be flexible, based on the demand at the three snowcoach entry locations (i.e., sharing among West, South, East, North, and Old Faithful).	Daily entrance allocation for snowcoaches would be flexible, to provide and accommodate a variety of winter experiences. For example, daily allocations not used at one gate could be used at another gate that same day.	Daily entrance allocation for snowcoaches would be flexible, to provide and accommodate a variety of winter experiences. For example, daily allocations not used at one gate could be used at another gate that same day.
Snowcoach Guide Requirements	n/a	Common to all action alternatives: snowcoach entry by commercial guide only.					
Snowcoach BAT requirements	n/a	Common to all action alternatives: BAT would be developed and implemented for snowcoaches by the 2014/2015 season. Draft proposal: Require vehicles meet Model Year 2010 EPA emission standards. Not to exceed 73 dBA when operating at or near full speed.					
Wheeled Vehicle Access							
	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road from Mammoth Hot Springs to Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. In addition, the north (Mammoth) and west (West Yellowstone) entrance roads would be plowed to Old Faithful to accommodate multi- passenger commercial vehicles (e.g., vans, buses, etc.). No private vehicles would be permitted. Daily limit of up to 100 Tier 2 (EPA standard) vehicles.	Wheeled vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the Mammoth to Cooke City Road. No other roads would be plowed for wheeled vehicle use.	Wheeled vehicle access would continue along the road from Mammoth Hot Springs to Cooke City. No other roads would be plowed for wheeled vehicle use.
Other/General Elements							
Road Grooming	Minimal road grooming needed to maintain administrative access. Sylvan Pass management would not be maintained.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.	Continued road grooming needed to maintain snowcoach and administrative access. Sylvan Pass would be closed to vehicle traffic and not be maintained.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement. Certain side roads would be groomed for non-motorized uses only during certain times/days of the season.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Zoning – Temporal and Spatial	n/a	Continued temporal and spatial zoning of some side roads (e.g., snowcoaches only in the morning, snowmobiles and snowcoaches in the afternoons).	Continued temporal and spatial zoning of some side roads (e.g., snowcoaches only in the morning, snowmobiles and snowcoaches in the afternoons).	Most side roads would become cross-country ski and snowshoe routes.	Most side roads would become cross-country ski and snowshoe routes.	Side roads would become ski and snowshoe routes at certain times of the season. OSV use would end at West Thumb Junction and at the Canyon developed area for the last two weeks of the season to accommodate more non-motorized snow recreation on the east side of the park. OSV permits would be allocated in ways that allow for zoning by space and time to accommodate a variety of visitor uses and to protect park resources.	Side roads would become ski and snowshoe routes throughout the season. These roads would be groomed. OSV use would end at West Thumb Parking Area Junction and at the South Canyon Rim Drive for the last two weeks of the season to accommodate more non-motorized snow recreation on the east side of the park. All OSVs must enter the park by 10:30 a.m.
Opportunities for non-motorized recreation use	Park would be open for skiing and snowshoe access. Most of the park would be considered “backcountry” for this type of use.	Continue to groom 35 miles of secondary park roads for cross-country skiers and snowshoers. Use will be permitted subject to Winter Severity Index.	Continue to groom 35 miles of secondary park roads for cross-country skiers and snowshoers. Use will be permitted subject to Winter Severity Index.	Use would be permitted subject to Winter Severity Index. Use on South and East entrance roads could increase during the park’s spring “shoulder” season. Continue to groom 35 miles of secondary roads for cross-country skiers and snowshoers. Additional secondary roads (approximately 10 miles) would be groomed for non-motorized use access at stopping points along plowed roads (primarily West to Old Faithful). Backcountry experience on east side of park would be available for non-motorized users.	Non-motorized use would be permitted subject to a Winter Severity Index for temperature and weather. Use along the South and East entrance roads could increase during the park’s spring “shoulder” season. Continue to groom 35 miles of secondary roads for cross-country skiers and snowshoers. Additional secondary roads (approximately 10 miles) would be groomed for non-motorized use access at stopping points along plowed roads (primarily from West Yellowstone to Old Faithful).	Allowed subject to Winter Severity Index. Manage non-motorized use in time and space to provide for a variety of visitor uses (see Zoning).	In addition to the roads and areas described above in Zoning – Temporal and Spatial, continue to groom 35 miles of secondary park roads for cross-country skiers and snowshoers. Use would be permitted subject to Winter Severity Index.
Dates/Length of Winter Season	The season would start when accumulation of snow allows for non-motorized use. It would continue into March, depending on snow levels and any closures for wildlife management and spring road plowing).	No change in current dates for motorized and non-motorized winter use in the park.	No change in current dates for motorized and non-motorized winter use in the park.	No change in current dates for motorized and non-motorized winter use in the park.	No change in current dates for motorized and non-motorized winter use in the park.	Opening and closing dates could vary to accommodate a variety of visitor experiences and needs. The schedule would be determined no later than Dec. 1 of the previous year.	No change in current dates for motorized and non-motorized winter use in the park; however, OSV use would not start before snow conditions permit.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors
Estimated number of daily vehicle passengers (excludes Mammoth to Cooke City)	Zero OSVs or wheeled vehicles	Snowmobile = 413 Snowcoach = 624 Total = 1,037	Snowmobile passengers = 936 Snowcoach passengers = 624 Total = 1,560	Snowmobile passengers = 143 Snowcoach passengers = 240 Wheeled vehicle passengers = 2000 Total = 2,383	Snowmobile passengers = 413 (potentially 0 after phase out) Snowcoach passengers = 624 (potentially 960 after phase out) Total = 1,037 (potentially 960 after phase out)	Snowmobile passengers = 408 Snowcoach passengers = 361 Total = 769	Days with 330 snowmobiles and 80 coaches: • Snowmobile passengers = 429 • Snowcoach passengers = 640 • Total = 1,069 Days with 220 snowmobiles and 50 coaches: • Snowmobile passengers = 286 • Snowcoach passengers = 400 • Total = 686 Days with 110 snowmobiles and 30 coaches: • Snowmobile passengers = 143 • Snowcoach passengers = 240 • Total = 383 Days with 143 snowmobiles and 80 coaches: • Snowmobile passengers = 186 • Snowcoach passengers = 640 • Total = 886
Transition Period	The 2009 interim rule expired. No transition period.	The 2009 interim rule would continue. No transition period.	There would be a one-season transition period to prepare for implementation of the new winter use plan. Provisions of the 2009 interim rule would continue during this transition.		Because the 2009 interim rule provisions are the starting point for alternative 5, there would not be a transition year.	There would be a one-season transition period to prepare for implementation of the new winter use plan. Provisions of the 2009 interim rule would continue during this transition.	
Adaptive Management Program	No adaptive management program would be implemented.	Common to all action alternatives: Adaptive management planning would be standard procedure, but elements and emphases of its use could differ from one alternative to another.					

TABLE 11: HOW ALTERNATIVES MEET OBJECTIVES

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Visitor Use							
Provide the opportunity for visitors to experience and be inspired by Yellowstone's unique winter resources and values while ensuring resource protection.	Meets objective to some degree because the interior of the park would be accessible only by non-motorized users and difficult to access by most visitors. Visitors could also continue to experience the park virtually through the park's website.	Meets objective to a large degree, because visitors would be able to experience the interior of the park with wheeled vehicles and OSVs from all entrances. Daily use limits of 318 snowmobiles and 78 snowcoaches would be similar to current use levels, which monitoring has shown allow for resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Meets objective to a moderate degree because visitors would be able to experience the interior of the park with wheeled vehicles and OSVs from all entrances. The increase in visitation over the current condition may lead to challenges in ensuring resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Fully meets objective because visitors would have a wide variety of choice in how to access the interior of the park, with these choices likely being more economical. With the addition of plowed roads, it is likely more visitors would be able to visit the park and see Yellowstone's unique winter resources. Use levels, and mix of use, would be expected to ensure resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Meets objective to a moderate degree because visitors would be provided the opportunity to experience the interior of the park using OSV; however, after the transition period, it is likely that the mode in which one can enter would be limited to snowcoaches. This alternative would reduce overall OSV traffic, below current levels, and would ensure resource protection. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Meets objective to a large degree because the variety of winter experiences would increase by creating times and places for higher and lower levels of use and opportunities for undisturbed skiing and snowshoeing. Although there would be the potential for days with higher use than the current condition, there would also be lower use days, and overall this alternative would ensure resource protection. Visitors would be able to experience the interior of the park with OSVs from all entrances. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.	Fully meets objective because the variety of winter experiences would increase by creating times and places for higher and lower levels of use and opportunities for undisturbed skiing and snowshoeing. Although use would have higher and lower use days, the maximum use days would be at levels that are similar to those currently permitted. With levels of use that those levels or less, this alternative would ensure resource protection. Visitors would be able to experience the interior of the park with OSVs from all entrances. Visitors could also continue to experience the park virtually through the park's website and webcam at Old Faithful.
Increase visitor understanding and appreciation of the park's winter resources.	Meets objective to some degree because the interior of the park would be closed to OSV use, greatly limiting the visitors that can experience this area. The park would continue to provide a virtual experience for all, including administration of the website to provide understanding and appreciation of the park's winter resources to those unable to visit the park.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.	Fully meets objective because visitors have the opportunity to visit the interior of the park and view Yellowstone in the winter, wildlife, and the park's unique geothermal features. In addition, the park would continue to provide a virtual experience for all, including administration of the website and web cam at Old Faithful to provide understanding and appreciation of the park's winter resources to those unable to visit.
Provide access for winter opportunities in the park that are appropriate and universally accessible.	Meets objectives to some degree because transportation to the interior of the park would no longer be available, but non-motorized uses and virtual visitation would continue.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Fully meets objective because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.	Meets objective to a large degree because access to winter opportunities in the interior of the park would include both snowmobile and snowcoach use. Access would be provided for a wide range of visitors.

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Resources							
Wildlife: Manage winter use so that it does not disrupt the winter wildlife ecology, including sensitive species.	Meets objective to a large degree because wildlife, including sensitive species, in the interior of the park would no longer have interactions with recreational OSV. Interactions with non-motorized users would continue to occur, on a limited basis.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be similar to those currently occurring, which monitoring has shown disrupts wildlife minimally.	Meets objective some degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be greater than those currently occurring, which could result in more disruption to wildlife.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of wheeled vehicles and OSVs. Winter use levels would be similar or less than to those currently occurring, which monitoring has shown disrupts wildlife minimally.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be less than to those currently occurring once the transition to snowcoaches only is complete, which monitoring has shown disrupts wildlife minimally.	Meets objective some degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be greater than those currently occurring, which could result in more disruption to wildlife.	Meets objective to a moderate degree because wildlife, including sensitive species, in the interior of the park have the potential to be displaced by the use of OSVs. Winter use levels would be similar to those currently occurring, which monitoring has shown disrupts wildlife minimally. Lower use days below the levels that are currently occurring would result in less disruption to wildlife.
Sound: Manage winter use to protect naturally occurring background sound levels and to minimize loud noises.	Meets objectives to a large degree because minimal OSV use (administrative use only) would occur in the interior of the park.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.	Meets objective to some degree because OSV use would occur in the interior of the park, at levels that would reduce times of natural quiet compared to current use levels.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.	Meets objectives to some degree because OSV use would occur in the interior of the park, at levels that would reduce times of natural quiet compared to current use levels.	Meets objective to a moderate degree because OSV use would occur in the interior of the park, but at levels that still allow for times of natural quiet.
Air Quality: Manage winter use to minimize impacts to resources that may be affected by air pollution including visibility and aquatic systems.	Meets objective to a large degree because minimal OSV use (administrative use only) would occur in the interior of the park and air emissions would be at very low levels.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to current use levels, which monitoring has shown to be below all regulatory standards.	Meets objective to a moderate degree because OSV use, and air emissions from that use, would continue in the interior of the park. Levels of use would be similar to or less than current use levels, which monitoring has shown to be below all regulatory standards.
Wilderness: Manage winter use to protect wilderness character and values.	Meets objective to a large degree because minimal OSV use (administrative use only) would not occur in the interior of the park.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.	Meets objective to a moderate degree because OSV use would occur in the interior of the park; however, modeling has shown that disturbances, specifically noise, would be limited in time and duration.

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Health and Safety							
Seek to manage access in the winter for the safety of all visitors and employees, including limiting impacts from emissions, noise, and known hazards.	Meets objective to a large degree because recreational OSV use would not occur in the interior of the park. Emissions, noise, and known hazards would be reduced because the interior of the park would be closed to the public; however, non-motorized use (skiing and snowshoeing) would be permitted in the interior of the park, resulting in known hazards from harsh winter conditions.	Meets objective to some degree **as** OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree **as** OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets the objectives to a large degree because wheeled vehicle, OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. The requirement for all wheeled vehicles to be commercially guided would further promote the health and safety of visitors. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Sylvan Pass would not continue to operate, greatly reducing the risk to park staff that would no longer be exposed to the hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree because OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree because OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.	Meets objective to some degree because OSV and non-motorized use would be permitted in the interior of the park, following guidelines and regulations to promote the over the health and safety of visitors such as hour of operation, BAT and guiding requirements. Visitors would have the potential to be exposed to emissions, noise, and known hazards. Additionally, Sylvan Pass would continue to operate and workers would continue to be exposed to hazardous conditions inherent in conducting operations in an avalanche prone area.
Coordination and Cooperation							
Improve coordination and communication regarding winter use management with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.	Fully meets objectives because the park would continue to coordinate and communicate with park partners, gateway communities, and other stakeholders.
Park Management/Operations							
Develop and implement an adaptive management program that includes monitoring the condition of resources.	Meets objective to a large degree because the adaptive management program under no action would differ from the action alternatives. It would focus on monitoring park resources in the near absence of OSVs and understanding if changes to limited administrative OSV use and non-motorized uses are needed.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.	Fully meets objective because adaptive management would occur under this alternative.

Objective	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Promote advances of vehicle technology (OSVs and commercial wheeled vehicles) that will reduce impacts and facilitate continuous improvement of technology over time.	Does not meet objective because OSVs would not be allowed into the park, reducing the incentive for the development of new technology.	Meets objective to a moderate degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. No additional steps would be taken to promote technology.	Meets objective to a moderate degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. No additional steps would be taken to promote technology.	Meets objective to a moderate degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. No additional steps would be taken to promote technology.	Meets objective to a large degree because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. Further incentives for the advancement of snowcoaches would be provided as more snowcoaches would be permitted as BAT becomes available. In addition, as new technologies come on line (electric for example) snowmobile operators would have the potential to replace BAT coaches.	Fully meets objective because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. In addition, as new technologies come on line (electric for example) operators would have the potential to increase their daily limits if they include newer, and cleaner, technologies in their fleets.	Fully meets objective because BAT requirements would continue to be implemented for snowmobiles and would further be developed and implemented for snowcoaches. In addition, new BAT requirements for NO_x would also be developed, which would also promote advances in technology and operators could have the potential to increase their daily limits if they include newer, and cleaner, technologies in their fleets.
Provide for winter use that is consistent with the park priority to provide critical visitor services at core locations.	Meets objective to some degree because services in the northern area of the park (Mammoth) would continue to be provided. Due to lack of OSV access, services in the interior of the park would not continue.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV and wheeled vehicle use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.	Meets objective to a large degree because services in the northern area of the park (Mammoth) would continue to be provided and OSV use would allow for the continuation of services in the interior of the park in the winter.

TABLE 12: IMPACT SUMMARY

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Wildlife and Wildlife Habitat, including Rare, Unique, Threatened, or Endangered Species, and Species of Concern							
Bison/Elk	Based on an analysis of the available data and literature regarding bison and elk in the greater Yellowstone area, the no-action alternative would result in short and long-term negligible adverse impacts on bison and elk in the park, because OSV use would be limited to minimal administrative use and non-motorized use would be more limited, resulting in no observable impacts. Human activity during the winter months would be reduced and any beneficial wildlife impacts would likely only be apparent over several decades of minimal OSV traffic in the park. Cumulative impacts under alternative 1 would be long-term minor to major adverse. Alternative 1 would contribute minimally to cumulative impacts because there would be no visitor OSVs in the park.	Alternative 2 would allow for use levels similar to the 2009 interim rule, with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Thus, overall impacts under alternative 2 would be short and long-term minor to moderate adverse. Cumulative impacts would be long-term minor to major adverse, of which alternative 2 would contribute minimally.	Under alternative 3, daily use limits of up to 720 snowmobiles and 78 snowcoaches along with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only would result in short and long-term minor to moderate adverse impacts. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Cumulative impacts on bison and elk under alternative 3 would be long-term minor to major adverse.	Under alternative 4, daily use limits of up to 110 snowmobiles, 100 guided wheeled vehicles, and 30 snowcoaches, along with BAT requirements, guiding regulations, speed limits, plowing design, and restrictions on OSV access to park roads only, would result in short- and long-term, negligible to minor adverse impacts. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Cumulative impacts would be long-term minor to major adverse, of which alternative 4 would be a small part.	The existing data suggest that the higher visual profile of a snowcoach may elicit stronger bison and elk behavioral responses than snowmobiles. Thus, restricting OSVs to just snowcoaches would not eliminate adverse effects on wildlife. However, the available literature on bison and elk indicate that lower OSV numbers and associated recreation reduce vehicle-caused mortality, wildlife displacement, behavior or physiology-related energy costs, and the potential for adverse demographic impacts, resulting in short and long-term minor adverse impacts. Cumulative impacts on bison and elk under alternative 5 would be long-term minor to major adverse, to which alternative 5 would contribute a small amount.	The variable number of OSVs allowed per day under this alternative would likely increase the behavioral responses of bison and elk due to daily unpredictability and reduced potential for habituation. These increased responses are due in part to the larger snowmobile group sizes (22 individual vehicles rather than 11) allowed under this alternative, which have been found to increase the probability of strong behavioral and associated physiological responses, leading to possible displacement of bison and elk and resulting in long-term moderate adverse impacts. Additionally, the unguided/non-commercially guided provision, variable daily OSV numbers, and high use limits may result in decreased habituation and increased behavioral, physiological and displacement responses by bison and elk. Measures under this alternative, including BAT snowmobiles, variable use limits, closing of certain roads to motorized traffic two weeks prior to the end of the season, and setting limits on seasonal numbers of snowmobiles and snowcoaches in the park, would help limit wildlife impacts. Impacts under alternative 6 would be long-term minor to moderate adverse, due to unguided provision, variable limits, and increased group size. Cumulative impacts on bison and elk under alternative 6 would be long-term minor to major adverse, to which alternative 6 would contribute a noticeable amount.	Alternative 7 would allow use levels similar to the 2009 interim rule, with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only. Variable use levels allow for continued monitoring and adaptive management to establish additional restrictions to be established should negative impacts on wildlife begin to occur. Thus, overall impacts under alternative 7 would be short- and long-term minor to moderate adverse. Cumulative impacts would be long-term minor to major adverse, to which alternative 7 would contribute a small amount.

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Lynx/Wolverine	Alternative 1 would result in short- and long-term negligible adverse impacts on lynx and wolverines in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts, with long-term beneficial impacts from the removal of human presence. Cumulative impacts of alternative 1 would be long-term minor to major adverse, of which alternative 1 would contribute minimally.	This alternative would maintain and allow OSV use at Sylvan Pass, the area of the park where human-wolverine interactions would be most likely to occur. However, daily entrance limits restrict the east entrance to just 20 snowmobiles and two snowcoaches per day, (five groups of OSVs), resulting in little use in this area, and minimal disturbance to wolverines. Restrictions on movements of lynx or wolverines during the winter months due to the presence and use of OSV routes in other areas of the park may limit reproductive success, dispersal, and overall genetic sustainability of the species, but such impacts are difficult to predict. Therefore, impacts predicted under this alternative would be long-term minor adverse, with the potential for moderate adverse impacts if lynx and wolverines travel outside the eastern area of the park. Cumulative impacts to lynx and wolverines under alternative 2 would be long-term minor to major adverse, of which alternative 2 would contribute a minimal amount.	This alternative continues to maintain and allow OSV use in Sylvan Pass, the area of the park where human-wolverine interactions are most likely to occur. Restrictions to movements of lynx or wolverines during the winter months due to the presence and high levels of use of OSV routes under alternative 3 (up to 720 snowmobiles and 78 snowcoaches) may also limit reproductive success, dispersal, and overall genetic sustainability of the species due to increased frequency of exposure and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under this alternative would be long-term moderate adverse. Cumulative impacts to lynx and wolverines under alternative 3 would be long-term minor to major adverse, of which alternative 3 would contribute a minimal amount.	Under this alternative Sylvan Pass would be closed to OSVs and maintenance activities would cease in the area of the park where human-wolverine interactions are most likely to occur. Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively low levels of use of OSV routes under alternative 4 (up to 110 snowmobiles, 100 wheeled buses, and 30 snowcoaches) would have few impacts on the reproductive success, dispersal, and overall genetic sustainability of the species due to decreased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts under alternative 4 would be short and long-term minor adverse, with long-term beneficial impacts from the removal of human presence at Sylvan Pass. Cumulative impacts under alternative 4 would be long-term minor to major adverse, of which alternative 4 would contribute a minimal amount.	Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively low levels of use of OSV routes under alternative 5 (up to 120 snowcoaches) and the low levels of OSV entry limits at the east entrance would have few impacts on reproductive success, dispersal, and overall genetic sustainability of the species due to decreased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under alternative 5 would be short and long-term negligible to minor, adverse. Cumulative impacts to lynx and wolverines under alternative 5 would be long-term minor to major adverse, to which alternative 5 would contribute minimally.	Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively high levels of use of OSV routes under alternative 6 (up to 540 snowmobiles and 78 snowcoaches), and the potential for higher OSV entry limits at the east entrance would have increased impacts on reproductive success, dispersal, and overall genetic sustainability of the species due to the increased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under alternative 6 would be short and long-term moderate adverse. Cumulative impacts to lynx and wolverines under alternative 6 would be long-term minor to major adverse, of which alternative 6 would contribute a noticeable amount.	This alternative would maintain and allow OSV use in Sylvan Pass, the area of the park where human-wolverine interactions would be most likely to occur. However, daily entrance limits restrict the east entrance to just 22 snowmobiles and 2 snowcoaches per day, (five groups of OSVs), resulting in little use in this area, and minimal disturbance to wolverines. Restrictions on movements of lynx or wolverines during the winter months due to the presence and use of OSV routes in other areas of the park may limit the reproductive success, dispersal, and overall genetic sustainability of the species, but such impacts are difficult to predict. Therefore, impacts predicted under this alternative would be long-term minor adverse, with the potential for moderate adverse impacts if lynx and wolverines travel outside the eastern area of the park. Cumulative impacts to lynx and wolverines under alternative 7 would be long-term minor to major adverse, to which alternative 7 would contribute a small amount.

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Trumpeter Swans/ Eagles	Alternative 1 would result in short- and long-term negligible adverse impacts on swans and eagles in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts. Cumulative impacts would be long-term minor adverse, and alternative 1 would contribute a minimally to the overall cumulative impacts to eagles and swans.	Alternative 2 would limit impacts to swans and eagles through use-limits, guiding requirements, and little overlap of OSV use with the active swan nesting season. Given these conditions and the mitigation measures discussed above, impacts to eagles and swans under alternative 2 would be localized short- to long-term negligible to minor adverse. Cumulative impacts would be long-term minor adverse, and alternative 2 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 3 would limit impacts to swans and eagles as described in alternative 2, but would allow for a greater number of OSVs in the park on a daily basis and would result in short and long-term minor adverse impacts. Cumulative impacts would be long-term minor adverse, and alternative 3 would contribute a noticeable amount to the overall adverse cumulative impact.	Alternative 4 would limit impacts to swans and eagles due to low use limits, reduction in overall motorized vehicle use in the winter within the park, guiding requirements, and little overlap with active swan nesting season. The low use levels and guiding requirements would result in localized short and long-term negligible adverse impacts to eagles and swans under alternative 4. Cumulative impacts would be long-term minor adverse, and alternative 4 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 5 would limit the impacts to swans and eagles through low use limits, guiding requirements, and little overlap between OSV use and the active swan nesting season. The low use levels and guiding requirements would limit impacts to eagles and swans under alternative 5 and result in localized short and long-term, negligible, adverse impacts. Cumulative impacts would be long-term minor adverse, and alternative 5 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 6 would limit impacts to swans and eagles due to use-limits, guiding requirements, and little overlap between OSV use and the active swan nesting season, but would increase OSV use levels on some days beyond current use levels. Impacts to eagles or swans under alternative 6 would be short- and long-term minor to moderate adverse because use levels would increase and up to 25% unguided/non-commercially guided snowmobile use would be permitted. Cumulative impacts would be long-term minor to moderate adverse, and alternative 6 would contribute a noticeable amount to the overall adverse cumulative impacts.	Alternative 7 would limit impacts to swans and eagles through use-limits, guiding requirements, and little overlap of OSV use with the active swan nesting season. Given these conditions and the mitigation measures discussed above, impacts to eagles and swans under alternative 7 would be localized short- to long-term negligible to minor adverse. Cumulative impacts would be long-term minor to moderate adverse, and alternative 7 would contribute minimally to the overall adverse cumulative impacts.
Gray Wolves	Alternative 1 would result in short- and long-term negligible adverse impacts on wolves in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts. The limited human presence would have long-term beneficial impacts. Cumulative impacts would be long-term, minor, adverse, and alternative 1 would contribute a small amount to the overall cumulative impacts.	Alternative 2 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to current use levels, which would reduce the frequency of OSV encounters, and limit the duration of interaction and the approach distance of OSV users due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 2 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 3 would result in short- and long-term minor adverse impacts on wolves in the park because OSV use would increase the frequency and duration of OSV exposure. The guiding requirement regulates the interaction time and approach distance of OSV users, limiting adverse impacts from direct interaction. Cumulative impacts would be long-term minor adverse, and alternative 3 would contribute a noticeable amount to the overall adverse cumulative impacts.	Alternative 4 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because motorized vehicle use would be limited to low use levels, which would reduce the frequency of motorized vehicle encounters with wolves, and limits duration and approach distance of OSV users when encountering wolves due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 4 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 5 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to low use levels which reduces the frequency of motorized vehicle encounters with wolves, and limits duration and approach distance of OSV users when encountering wolves due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 5 would contribute a small amount to the overall adverse cumulative impacts.	Alternative 6 would result in long-term minor to moderate adverse impacts on wolves in the park because OSV use would increase to relatively high use levels, which would increase the frequency of OSV encounters with wolves and the duration of OSV presence. The unguided snowmobile provision may result in improper behavior and decreased approach distance of OSV users when encountering wolves. Cumulative impacts would be long-term minor to moderate adverse and alternative 6 would contribute a noticeable amount to the overall adverse cumulative.	Alternative 7 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to current use levels, which would reduce the frequency of OSV encounters and limit the duration and approach distance of OSV users due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 7 would contribute a small amount to the overall adverse cumulative impacts.
Air Quality	The effects of alternative 1 on air quality and visibility would be long-term negligible adverse. Cumulative impacts would result in long-term minor adverse impacts on air quality.	The effect of alternative 2 on air quality would be long-term minor adverse. The effect of alternative 2 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 3 on air quality would be long-term minor adverse. The effect of alternative 3 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 4 on air quality would be long-term minor adverse. The effect of alternative 4 on visibility would be long-term minor adverse. Cumulative impacts to air quality and visibility would be long-term, minor adverse.	The effects of alternative 5 on air quality would be long-term minor adverse. The effect of alternative 5 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 6 on air quality would be long-term minor adverse. The effect of alternative 6 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.	The effect of alternative 7 on air quality would be long-term minor adverse. The effect of alternative 7 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.

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Soundscapes	The effects of alternative 1 on soundscapes would be long-term, minor to moderate, and adverse due to administrative OSV use. Moderate impacts would be limited to travel corridors. Cumulative impacts to soundscapes would be long-term, minor and adverse.	The effects of alternative 2 on soundscapes would be long-term, moderate and adverse due to the level of OSV use permitted. Cumulative impacts to soundscapes would be long-term, moderate and adverse.	The effects of alternative 3 on soundscapes would be long-term, moderate to major and adverse. Major impacts would be limited to the travel corridor, due to the increased level of OSV use. Cumulative impacts to soundscapes would be long-term, moderate to major and adverse.	The effects of alternative 4 on soundscapes would be long-term, moderate and adverse, due to the permitted level of OSV use. Cumulative impacts to soundscapes would be long-term, moderate and adverse.	The effects of alternative 5 on soundscapes would be long-term, moderate and adverse, both before and after the phase out to snowmobiles only. Cumulative impacts to soundscapes would be long-term, moderate and adverse.	The effects of alternative 6 on soundscapes would be long-term, moderate to major, adverse representing the range between low and high use days under alternative 6. Cumulative impacts to soundscapes would be long-term, moderate to major and adverse.	The effect of alternative 7 on soundscapes would be long-term, moderate adverse. Cumulative impacts to soundscapes would be long-term, moderate and adverse.
Visitor Use and Experience	Restricting winter access to the interior of the park by non-motorized means would result in long-term major adverse impacts on the visitor use and experience. Winter visitors desiring either or both non-motorized and motorized experiences would be affected by loss of access. Overall cumulative effects would be long-term major adverse.	Under alternative 2, continuing OSV use and access in accordance with the 2009 interim rule limits would meet recent demand for winter visitation and provide limited opportunities for growth. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. Resource conditions (i.e., wildlife, soundscapes, and air quality), which support a quality visitor experience, would experience long-term negligible to moderate adverse effects. Therefore, alternative 2 would result in long-term benefits to visitor use and experience. Cumulative impacts to visitor use and experience under alternative 2 would be long-term and beneficial.	Under alternative 3, increasing OSV numbers and allowing access in accordance with the 2004 plan limits would provide opportunities for OSV users to experience Yellowstone in the winter, and would allow for some growth in OSV use as compared to what was observed between 2004 and 2009. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior, but all users could experience a decrease in satisfaction because resources could be impacted by increased OSV use. Resource conditions (i.e., wildlife and soundscapes) would be affected to a greater extent than in recent years and may affect the ability to view wildlife and experience natural sounds. Overall, alternative 3 would result in long-term benefits to visitor experience and access, with long-term minor adverse impacts occurring from any decrease in visitor satisfaction. Cumulative impacts to visitor use and experience under alternative 3 would be long-term and beneficial.	Under alternative 4, changes in visitor access and experience created by introducing wheeled vehicles access and limiting OSV access would result in a distinctively different winter visitor experience. Parkwide, long-term beneficial impacts would result compared with alternative 1. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. However, expectations for OSV access and experience would not likely be met because of the decrease in the number of snowmobiles and snowcoaches permitted in the park on any given day, resulting in long-term moderate adverse impacts for this user group. Overall, alternative 4 would result in long-term beneficial impact and long-term minor to moderate adverse impacts to visitor experience and access. Cumulative impacts to visitor use and experience would be long-term minor to moderate adverse and long-term beneficial.	Under alternative 5, changes in visitor experience created by the potential transition to snowcoach access only would result in parkwide, long-term benefits compared to the no-action alternative. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. However, the opportunity to experience a specific, individual snowmobile experience as offered in the past would be lost. This would result in the potential for visitors' expectations not to be met. Overall, alternative 5 would result in long-term beneficial impacts to visitor experience and access, with long-term moderate adverse impacts to those wishing to engage in snowmobile use. Cumulative impacts to visitor use and experience would be long-term beneficial and long-term moderate adverse.	Under alternative 6, increases in OSV allocations and flexibility in daily use would result in parkwide, long-term beneficial impacts compared to the no-action alternative. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior, and visitors could plan their trip around the use level for that day and their desired experience. Resource conditions (e.g., wildlife and soundscapes) would be affected to a greater extent than in recent years, somewhat affecting the visitors' ability to view wildlife and experience natural sounds. Overall, alternative 6 would result in long-term benefits to visitor experience and access, with potential negligible to minor impacts for visitors that cannot accommodate their desired experience. Cumulative impacts would be long-term minor adverse as well as long-term beneficial.	Under alternative 7, varying OSV allocations and flexibility in daily use would result in parkwide, long-term beneficial impacts compared to the no-action alternative. Visitors could plan their trip around desired use and experiences, but limited OSV availability early and later in the winter season may result in unmet expectations for OSV visitors. Resource conditions (soundscapes and wildlife) would be affected to a lesser extent than in recent years, somewhat improving visitors' ability to view experience natural sounds and view wildlife. Overall, alternative 7 would result in long-term benefits to visitor experience and access, with potential minor to moderate adverse impacts for visitors that cannot obtain their desired experience. Cumulative impacts would be long-term, minor to moderate, adverse, as well as long-term beneficial.

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Visitor Accessibility	Restricting winter access to the interior of the park to non-motorized methods would result in long-term major adverse impacts to visitor accessibility; including the very young, the elderly, and the mobility-impaired visitors. Accessible regional opportunities for winter recreation would offset these adverse impacts somewhat. Cumulative impacts to visitor accessibility would be long-term major adverse, to which alternative 1 would contribute a large part.	Under alternative 2, continuing OSV numbers and routes in accordance with the 2009 interim rule limits would meet demand (based on use levels for the 2009/2010 winter season) for accessible winter visitation for the very young, the elderly, and the mobility impaired. Opportunities for increased visitation for those with mobility needs would also be accommodated. Thus, alternative 2 would result in long-term beneficial impacts to visitor accessibility. Cumulative impacts under alternative 2 would be long-term and beneficial.	Under alternative 3, OSV numbers and routes in accordance with the 2004 Winter Use Plan limits would meet the demand (based on use levels for the 2009/2010 winter season) for a winter experience that can be enjoyed by the very young, the elderly, and the mobility impaired. Opportunities for increased accessible visitation would also be accommodated. Therefore, alternative 3 would result in long-term benefits to visitor accessibility. Cumulative impacts under alternative 3 would be long-term and beneficial.	Under alternative 4, distinct accessibility options of snowcoaches, snowmobiles, and wheeled vehicles would be available for exploring Yellowstone in winter. However, accessible snowcoach experiences may not be available to all seeking them. Nonetheless, the availability of wheeled, accessible vehicles would potentially provide the greatest degree of accessibility of the proposed alternatives. This would result in parkwide, long-term beneficial impacts to accessibility when compared to the no-action alternative, with the potential for long-term minor adverse impacts due to the limited availability of snowcoach access. Cumulative impacts would be long-term beneficial.	Under alternative 5, changes in visitor experience created by the potential transition to snowcoach access only would result in parkwide, long-term beneficial impacts compared to the no-action alternative. For those seeking snowmobile experiences, impacts would be long-term, minor to moderate adverse. Cumulative impacts would be long-term and beneficial.	Under alternative 6, total snowcoach allocations would be similar to those in the 2009/2010 winter season. Flexibility in routes and gate entry numbers would potentially increase accessible snowcoach use. This would result in parkwide, long-term beneficial impacts to accessibility compared to the no-action alternative. Cumulative impacts would be long-term and beneficial.	Under alternative 7, OSV allocations would vary within the winter use season, and would be expected to support current and future accessibility demands. This would result in parkwide, long-term beneficial impacts to accessibility compared to the no-action alternative. Cumulative impacts would be long-term and beneficial.
Health and Safety	Overall, air pollution and noise levels would be limited to administrative OSV use and would be minimal, and the closure of Sylvan Pass would reduce the avalanche risk to staff. Therefore, impacts to health and safety would be long-term negligible adverse and long-term beneficial to health and safety, with the potential for long-term minor adverse impacts from the possibility of non-motorized users being out in harsh winter conditions with minimal support facilities. Cumulative impacts would be long-term, negligible adverse.	Under alternative 2, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts under alternative 2 would be long-term minor adverse.	Under alternative 3, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.	Under alternative 4, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term beneficial from the closure of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term negligible adverse.	Under alternative 5, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements, both before and after the transition to snowcoach only. Cumulative impacts would be long-term minor adverse.	Under alternative 6, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor to moderate adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.	Under alternative 7, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Socioeconomic Values	The impacts are estimated to be negligible, adverse, and long term for the three-state area, the five-county area and Cody and Jackson, Wyoming. West Yellowstone is projected to experience minor, adverse, long-term impacts. As described earlier, the adverse direct impacts would be most directly felt by communities and businesses near the park, especially in areas that have a higher proportion of business tied directly to park visitation. At the north entrance, Gardiner, Montana, might experience beneficial impacts if visitors who would have visited the other entrances switch to the North. The IMPLAN modeling captures the indirect and induced effects as well. As individual businesses are adversely affected, they would reduce purchases of other goods and services from suppliers. Conversely if individual businesses are beneficially affected they would increase the purchase of goods and services from suppliers. These feedback effects impact sectors of the economy beyond those that are influenced directly by visitors. Cumulative impacts would be long-term negligible adverse or beneficial cumulative impacts on the socioeconomic environment. In West Yellowstone cumulative negligible to minor adverse impacts could result.	Compared to alternative 1, alternative 2 would result in beneficial, long-term impacts for the three-state area, the five county area, and the communities of Cody and Jackson. In West Yellowstone, the beneficial, long-term impacts would be larger on average. Alternative 2 continues current management, under which there has been some increase in visitation, especially for snowcoach use. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, alternative 3 is expected to result in negligible to beneficial, long-term impacts for the states, counties and communities surrounding Yellowstone. West Yellowstone could experience larger beneficial, long-term impacts compared to the other communities. Alternative 3 has higher daily limits on snowmobile and snowcoach use, and so the alternative could accommodate higher growth in visitation than all the alternatives, except alternative 4. If demand for snowmobile and snowcoach tours grew beyond the current limits, alternative 3 would allow for a larger increase in visitation by out-of-region visitors. However, the lower estimate of visitation is equal to alternative 2 because the snowmobiles must still be part of a guided tour and must meet BAT restrictions. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, all the communities are expected to experience beneficial, long-term impacts and West Yellowstone is expected to experience the largest beneficial impacts. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term beneficial impacts of alternative 4 would result in long-term beneficial cumulative impacts on the socioeconomic environment. The size of the impacts would depend on demand for commercial, wheeled vehicle tours out of the west and north entrances, which would represent a new winter experience for visitors. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, alternative 5 is expected to have on average beneficial, long-term impacts for all the communities, as seen in tables 65, 66 and 67. In order to generate larger beneficial impacts under this alternative, demand for snowcoach tours must increase to more than make up for the eventual phase-out of snowmobiles. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, alternative 6 could provide beneficial, long-term impacts for all the communities, the three-state area, and the five-county area. West Yellowstone could experience larger, beneficial long-term impacts, on average, as reported in tables 65, 66 and 67. The larger beneficial impacts are more likely under this alternative compared to others because of the provision for unguided snowmobile trips, which were historically more popular. Cumulative impacts would be long-term beneficial.	Compared to alternative 1, alternative 7 could provide beneficial, long-term impacts for the three-state area, the five-county area, and the three communities. West Yellowstone could reach larger, beneficial, long term impacts, on average, as reported in tables 65, 66 and 67. Cumulative impacts would be long-term beneficial.

	Alternative 1: No Action - No Snowmobile / Snowcoach Use	Alternative 2: Continue Snowmobile / Snowcoach Use at 2008 Plan Limits	Alternative 3: Return Snowmobile / Snowcoach use to 2004 Plan Limits	Alternative 4: Mixed Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	Alternative 5: Transition to BAT Snowcoaches Only Based on User Demand	Alternative 6: Implement Variable Management	Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (Preferred Alternative)
Park Operations and Management	Alternative 1 would have long-term negligible adverse impacts to park operations because staffing and resource requirements would be covered by existing funding, as well as long-term benefits from the potential reallocation of staff to other areas of the park during the winter season. In addition, fuel requirements and green house gas emissions would be reduced from current levels because the number of staff needed in the interior of the park, and therefore OSV use, would be reduced. Cumulative impacts under alternative 1 would be long-term, negligible to minor adverse, of which alternative 1 would contribute a large part.	Alternative 2 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded, and this level of funding would be expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 2 would be long-term negligible to minor adverse, of which alternative 2 would constitute a large part.	Alternative 3 would result in long-term minor to moderate adverse impacts because the staffing and resource requirements would require additional funding that may or may not be available in the park's annual budget. Any additional resources required may impact park operations and could be slightly noticeable to park staff and visitors when resources are allocated from one part of the park to another. Cumulative impacts under alternative 3 would be long-term minor to moderate adverse, of which alternative 3 would constitute a large part.	Alternative 4 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 4 would be long-term negligible to minor adverse, of which alternative 4 would constitute a large part.	Alternative 5 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative as well as the slight increase in funding required over current conditions may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 5 would be long-term negligible to minor adverse, of which alternative 5 would constitute a large part.	Alternative 6 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded (if not slightly lower), and this level of funding expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 6 would be long-term negligible to minor adverse, of which alternative 6 would constitute a large part.	Alternative 7 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to current funding (if not slightly lower), and this level of funding would be expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 7 would be long-term negligible to minor adverse, of which alternative 7 would constitute a large part.

CHAPTER 3

Affected Environment

CHAPTER 3: AFFECTED ENVIRONMENT

The "Affected Environment" describes current condition of the resources and values of Yellowstone National Park (Yellowstone or the park) that would be affected by the implementation of the proposed winter use alternatives. The resource value topics presented in this chapter, and the organization of the topics, correspond to the resource impact discussions contained in "Chapter 4: Environmental Consequences" immediately following this chapter.

WILDLIFE AND WILDLIFE HABITAT, INCLUDING RARE, UNIQUE, THREATENED, OR ENDANGERED SPECIES, AND SPECIES OF CONCERN

Winter conditions, increased energy demands, and decreased mobility due to snow result in stress to active wildlife during the winter months.

Yellowstone provides winter habitat for many terrestrial wildlife species, including bison, elk, mule deer, moose, bighorn sheep, mountain lions, lynx, bobcats, martens, fishers, river otters, wolverines, coyotes, gray wolves, red foxes, and snowshoe hares. Avian species that overwinter in Yellowstone include trumpeter swans, bald eagles, common ravens, gray jays, Clark's nutcrackers, great gray owls, and a variety of waterfowl, raptors, and passerine bird species (Olliff et al. 1999). Species, such as grizzly and black bears, hibernate during winter months, and are rarely encountered by oversnow vehicles (OSVs). Winter conditions, increased energy demands, and decreased mobility due to snow result in stress to wildlife that are active during the winter months. Many species of wildlife that spend the winter in the park would be adversely impacted to a negligible to minor level by OSV use. Some of these species have winter ranges primarily outside of park boundaries, or in areas of the park not subject to OSV use, are rarely exposed to OSVs, and are unlikely to suffer higher than minor adverse impacts by exposure to OSVS, and/or are not federally listed or of special concern in the park. These species are dismissed from further discussion in chapter 1. Species that were carried through for analysis include bison, elk, lynx, wolverines, gray wolves, trumpeter swans, and bald eagles.

The park and other researchers have conducted a variety of monitoring projects and other studies on wildlife in the park in the winter. Some of these have focused on interaction with winter recreation; others have been aimed at better understanding the existence and ecology of different species. For example, the park has conducted annual winter wildlife monitoring observation studies along motorized OSV routes from winter 1999 to winter 2009. The studies focused on interaction of wildlife and OSVs. Wildlife observed were primarily bison, elk, trumpeter swans and bald eagles, with rare sightings of gray wolves. In addition, a previous study looked at the interaction of elk and cross-country skiers (Cassirer et al. 1992). Many studies also looked at the relation of groomed roads to the movement of bison.

Other species included in this analysis, particularly lynx and wolverines, are secretive, live in forested or mountainous areas with reduced visibility, and/or actively avoid encounters with humans. Because of this, there is limited information on lynx or wolverine ecology, or on the impacts of OSV use and human presence on lynx or wolverine behavior, movements, distribution, or population. Recently, two studies were started to better understand the existence and ecology of wolverines in the greater Yellowstone area. Due to the limited availability of information on lynx and wolverines in Yellowstone, behavioral, displacement, and population-level responses to OSVs by lynx and wolverines are based on research observations in available literature regarding the amount of human disturbance, roads, and motorized vehicle use tolerated in habitat used by these species. Human-caused disturbances in the park due to winter use include OSV traffic, aircraft, non-motorized foot traffic and skiing, and other noise-related disturbances. This winter plan focuses primarily on OSV use in the park, and OSV related disturbance on wildlife is of primary concern in this analysis. The following overview is supplemented by the Scientific Assessment of Yellowstone National Park Winter Use Report.

RECENT RESEARCH AND MONITORING

From 1999 to 2009, researchers have monitored the behavioral responses of individual bison, trumpeter swans, bald eagles, and elk (and, more rarely, coyotes, wolves and golden eagles) to OSVs passing by or stopping on groomed roads. In addition, responses to related activities by OSV users, such as dismounting snowmobiles or exiting snowcoaches, were also monitored. Several recent publications have been based, in part, on data from this monitoring (White et al. 2008; Borkowski et al. 2006; Bruggeman et al. 2007; Bruggeman et al. 2006; White et al. 2006). Four of these studies (Borkowski et al. 2006; Bruggeman et al. 2007; Bruggeman et al. 2006; White et al. 2006) were part of a collaboration between the National Park Service (NPS) and Montana State University-Bozeman investigating the effects of winter recreation on Yellowstone’s wildlife. Borkowski et al. (2006) included observations of 6,508 encounters between OSVs and OSV users and wildlife between 1999 and 2004, and White et al. (2008) included 5,688 observations of wildlife/OSV and OSV user encounters between 2002 and 2006.

In ascertaining the effects of winter recreation on wildlife, understanding whether an individual animal has habituated to human disturbance compared to being tolerant of disturbance is important (Bejder et al. 2009; Cyr and Romero 2009). Habituation is the process by which animals learn to minimize their response to a potential disturbance through repeated neutral or non-threatening exposures to the stimulus. Habituation may result in energetic savings to animals not inclined to flee from neutral stimuli, but may also increase vulnerability to disease, natural predators, or increased mortality risks from vehicle collisions (Boyle and Samson 1985; Bejder et al. 2009). Habituation should not be confused with tolerance, which is defined as the acceptance of disturbance. An animal may tolerate disturbance stimuli for a variety of ecological reasons separate from the behavioral process of habituation. For example, individuals may tolerate disturbance if they cannot afford energetically to respond, need to remain in an area to avoid predation risks or competition, or if there are no suitable habitats nearby in which to move (Gill et al. 2001; Frid and Dill 2002; Bejder et al. 2009).

It is difficult to generalize about patterns of wildlife habituation to human disturbance because, in many cases, responses are specific to certain species (Belanger and Bedard 1990) and individualistic (Runyan and Blumstein 2004; Ellenberg et al. 2009). Further, many factors condition an animal’s responses to disturbance, often obscuring the distinction between habituation and tolerance. The decision of an animal to move from a disturbed area is based on a number of factors including the quality of the site occupied, distance to and quality of other sites, relative risk of predation or competition, dominance rank, and investment a given individual has made in its current site (Gill et al. 2001). Animals with no suitable habitat nearby or within traveling distance may be constrained from movement despite the disturbance (Frid and Dill 2002).

Studies conducted at the park indicate that animals rarely demonstrated active responses to OSV and associated human presence (table 13). Based on these findings it would appear that bison, elk, swans and eagles have become desensitized to OSV use and other human disturbance in the park during winter to some extent (Borkowski et al. 2006; White et al. 2008). Bison have been documented to be least likely to react to OSV-related disturbances during winters with greatest visitation, possibly suggesting habituation to high-intensity winter use (White et al. 2008). In contrast, elk did not appear to habituate to the repeated presence of skiers (Cassirer et al. 1992).

TABLE 13: OBSERVED RESPONSES OF WILDLIFE TO OSV USE

	Bison		Elk		Trumpeter Swans	Bald Eagles
Observed Response	Borkowski et al. 2006	White et al. 2008	Borkowski et al. 2006	White et al. 2008	White et al. 2008	White et al. 2008
No Apparent Response	81%	80%	48%	48%	57%	17%
Look-Resume	8%	9%	32%	27%	21%	64%
Alert	2%	3%	12%	17%	12%	9%
Travel	7%	5%	6%	5%	9%	4%
Flight	1%	2%	2%	2%	1%	6%
Defensive	<1%	<1%	<1%	<1%	0%	0%

Studies suggest that most of the individual wildlife observed in Yellowstone, including bison, elk, trumpeter swans, bald eagles, and coyotes, respond to OSV activities by reacting to the potential threat, generally observed as vigilant behavior by the animal (ears up, head raised, ceasing a previous activity such as grazing, without additional alert behavior) (McClure et al. 2009; White et al. 2008). If the animal perceives the disturbance as a more serious threat it may demonstrate an active response including travel away from the threat (walking), flight (running), or defense/attack directed at the threat (charging) (Borkowski et al. 2006; White et al. 2006; White et al. 2008). In most cases, more active responses require greater energy, reducing the amount of energy available to an animal for winter survival (Parker et al. 1984; Cassirer et al. 1992).

Collectively, all species observed in Yellowstone exhibited non-travel responses (no response, look-resume, alert response) to human activities at least 90% of the time (table 13). All species demonstrated active responses (travel, flight, defensive) less than 10% of the time. Defensive responses (charging) to OSV-related human activities were rare (Borkowski et al. 2006; McClure et al. 2009; White et al. 2008).

White et al. (2008) assessed the relationship between wildlife behavioral responses and factors including wildlife group size or distance from road, interaction time, number of snowmobiles or snowcoaches, type of habitat, and cumulative winter OSV traffic. For bison, elk, swans, and bald eagles, odds of a movement response (travel, flight) decreased with increasing distance of the animals from the road. As the number of individual animals in a group increased, the odds of a movement response generally decreased for bison, swans and elk in thermal habitat, whereas the odds of a movement response increased with larger group size for elk in wetland or unburned forest habitat. The odds of a movement response by wildlife increased with larger OSV group size, longer interaction time, direct approaches by OSV users, or specific habitat-species combinations (White et al. 2008).

Apparent habituation could also mean an animal is under physiological stress and would, under healthy circumstances, respond to the threat. A method used to determine the impact of OSVs on wildlife is to measure the level of stress hormones or glucocorticoids (GC) levels in blood or feces of the animal. However, GC levels do not allow researchers to differentiate between stressors (e.g., predator pressure, extreme weather, OSV presence), and vary with such factors as the time of year and reproductive and nutritional status of the animal. GC levels of bison, elk, and wolves during the winters of 1999 and 2000 provide an example of the difficulty in interpreting GC levels. Creel's analysis from one season showed that GC levels in elk were significantly higher during the snowmobile season than during wheeled vehicle season, after controlling for the effects of age and snow depth (Creel 2002). Based on the data used in the Creel study, Hardy (2001) found that data from winter

Apparent habituation could also mean an animal is under physiological stress and would, under healthy circumstances, respond to the threat.

2000 showed no obvious trends between daily OSV traffic and GC levels in elk (Hardy 2001; Borkowski eat al. 2006). Hardy (2001) did not detect any significant links between OSV usage and bison GC levels during these two winters (winter 1999 and winter 2000). The disparities in the data demonstrate the difficulties in interpreting GC data, because many factors are not stress related, including age, seasonal patterns in GC secretion, sex, body condition, diet, social ranking and reproductive status (Hardy 2001; Borkowski 2006). Also, this study took place prior to OSV guiding requirements and the introduction of wolves in Yellowstone, both of which may have affected GC levels.

Unless behavioral observational studies are combined with more costly studies that would include tagging individuals, using Global Positioning System (GPS) to track movements, and measuring stress hormone levels in the animals, along with individual mortality and reproductive data, it is difficult to conclude what effect, if any, OSV use has on individuals or populations by observational studies alone. As discussed in the following section, data collected thus far do not indicate that OSV use in the park has population-level effects for any of the species studies to date (White et al. 2008; Plumb et al. 2009).

In addition to wildlife monitoring, researchers and NPS staff monitored population and demographic trends for bison, elk, trumpeter swans, and bald eagles in relation to varying levels of OSV use in the park (Fuller et al. 2007; Wagner 2006; Bruggeman et al. 2007; White et al. 2008). The data from these studies provides no evidence that OSV use has adversely affected the demography or population dynamics of the wildlife studied relative to other, more important factors including the reintroduction of wolves, vegetation succession following the 1988 fires, and annual variation in snow pack and winter weather (Garrott et al. 2009; also see the Scientific Assessment of Yellowstone National Park Winter Use).

BISON (*BISON BISON*)

Yellowstone is the only area in the United States continually occupied by wild, free-ranging bison (IUCN 2010; Plumb and Sucec 2006).

Yellowstone is the only area in the United States continually occupied by wild, free-ranging bison (Gates et al. 2010; Plumb and Sucec 2006). Bison are gregarious, social animals and travel together in large herds of females and calves, with bulls lingering on the outside of the group. A healthy bull bison stands 6 feet at the withers and weighs about 2,000 pounds (one ton). Females are slightly smaller than males. Both sexes have horns, a large head, and a heavily muscled neck. Bison forage on sedges and grasses, and during Yellowstone's winters generally split into smaller groups and travel to lower elevations with less snow cover, including open meadows and geothermal areas. Geothermal areas are important to the winter survival of bison, providing snow-free or low-snow cover areas where bison can forage and conserve the energy needed to travel in deep snowpack (Gates et al. 2005; Garrott et al. 2009).

The Yellowstone bison population generally consists of a central herd and a northern herd, but the herds do intermingle. The ranges for both bison and elk are shown in figure 7. The central herd is generally found either in the Lamar or Hayden valleys during summer and moves to the Firehole River drainage, Madison headwaters, or Madison Valley meadow complexes during the winter. Alternatively, the herd may also travel north to meadow complexes historically used by the northern herd. The central herd's range experiences harsh winter conditions, with temperatures down to -42°C and heavy snows, and winter foraging habitat is shared with 100 to 600 elk. Bison from the northern herd are found almost exclusively in the Lamar Valley during summer, and move down an elevation gradient to the Blacktail Deer Plateau and Gardiner Basin meadow complexes as winter progresses. The northern herd's range is generally lower, warmer, and drier than the central herd's range and is shared with about 6,070 elk, as counted during winter aerial surveys in 2010. Currently about 60% of Yellowstone's winter bison population inhabits the northern range, and the remainder winters in the central range (NPS 2010e; Plumb et al. 2009).

FIGURE 7: RANGES FOR BISON AND ELK

Winter is a difficult time for many species, and historically 9% to 10% of bison die due to increased stress under winter conditions. Under natural conditions, old, young, sick, and disabled bison are the most vulnerable during major episodes of winter stress, low forage availability, and higher bison densities. Their carcasses are scavenged by many species, including mammals, birds, and insects, and play an important role in park ecology (NPS 1998b). Bison carcasses are especially important as a high-quality food source for species of concern including grizzly bears, bald eagles, and gray wolves (Swensen et al. 1986; Green et al. 1997; Smith et al. 1998).

Historical and Current Park Management of Bison


Bison

Bison management practices in the greater Yellowstone area have progressed through several phases since the park's inception, including intensive husbandry operations, herd control, "natural regulation" policy, and hunting or culling when animals leave the park boundaries (Gates et al. 2005; NPS 2008a). This long and complex history is summarized in the Gates report (2005), available at http://www.nps.gov/yell/naturescience/gatesbison.htm. Long-term data indicate that the population of bison in the park has steadily increased from a low of only 23 animals in 1901 to a high of 5,000 animals in 2005, with the bison population fluctuating between 2,000 and 5,000 animals since 1980 (Gates et al. 2005; Wallen 2008). A recent aerial survey of Yellowstone bison, conducted in summer 2010, estimated a total population of about 3,900 animals (NPS 2010e). Bison herd numbers have increased following a large drop in population during winter 2008 due to management removals at the Montana border to prevent bison from leaving Yellowstone.

After cessation of culling in the park's interior in 1968, the bison population generally increased, with minor fluctuations, to a high of 5,000 animals in winter 2005. Most of this increase in population coincided with a substantial increase in OSV recreation, with winter visitors increasing from 5,000 to nearly 100,000 people during this same period (Gates et al. 2005). The number of OSV riders in the west-central region of the park, where bison are common also increased during this time. Thus, in general the number of bison-OSV interactions has increased steadily since the introduction of OSVs in the park, despite high levels of OSVs pre-management, and there appears to be few population-level impacts on bison. In recent years, use numbers of OSVs have decreased, and since 2004, the number of winter visitors has fallen to between 50,000 and 60,000 people (NPS 2008a).

Management removals at (or near) the park boundary and severe winters have been the primary causes of bison mortality in the park. The risk of brucellosis (a contagious bacterial disease associated with spontaneous abortion in cattle) transmission from bison to cattle, and the economic cost associated with this risk prompted the development of various bison management plans over the last 20 years. Starting in the mid-1980s, federal and state agencies negotiated a series of management agreements to manage bison outside the park, the most recent being the Adaptive Adjustments to the Interagency Bison Management Plan (IBMP) in 2008, providing adjustments to the 2000 Final Environmental Impact Statement/plan for bison management. Management measures from the 2000 IBMP included hazing bison back into the park; capture, brucellosis testing, and removal of bison that repeatedly leave the park; and the culling of bison by agency personnel. An adaptive adjustment to the IBMP in 2005 also includes a measure for hunting bison outside the park. The IBMP is designed to conserve a wild and free-ranging bison population, while reducing the risk of brucellosis transmission to cattle. New policies allow untested females or mixed groups of bison to migrate onto and occupy Horse Butte peninsula and the Flats each winter and during spring calving season. Controls include hazing bison back into the park in May, lethal removal, and retaining animals in facilities for brucellosis testing and eventual release or culling. If populations drop below 2,300 bison, the agencies increase implementation of non-lethal measures and if populations drop below 2,100 bison, agencies cease lethal management and hunting and shift to non-lethal management measures. The Adaptive Adjustments to the IBMP (NPS 2008a) calls for an increase in bison vaccinations via National Environmental Policy Act processes resulting in completion of the Brucellosis Remote Vaccination Program for Bison Environmental Impact Statement (EIS). The EIS and National Environmental Policy Act process will be used to determine active management practices used during implementation of the Brucellosis Remote Vaccination Program for Bison EIS. The proposed Brucellosis Remote Vaccination Program for Bison is designed to protect Yellowstone bison by reducing brucellosis infections and, ultimately, to further reduce risk of transmission to cattle outside the park. The purpose of remote delivery vaccination is to deliver a low risk, effective vaccine to eligible bison inside the park to (1) decrease the probability of bison shedding *Brucella abortus,* (2) lower the brucellosis infection rate, and (3) increase public tolerance for bison on essential winter ranges in Montana.

Behavioral Reponses of Bison to Winter Visitors

Before the implementation of mandatory guiding, conflicts between OSV users and wildlife were common (Dimmick 2003). Rangers were frequently dispatched to the scene of wildlife/visitor conflicts to direct traffic and ensure the safety of both visitors and wildlife. OSV users cited for off-road violations often stated that they were attempting to evade or go around bison (Dimmick 2002, 2003; NPS 2008a).

Bison

Implementation of mandatory guiding has substantially reduced wildlife-visitor conflicts. Trained guides are knowledgeable about where wildlife is likely to occur and how to avoid harassing behavior. Guides enforce park rules including speed limits and restrictions on off-road travel (Taber 2006; NPS 2008a). Because guides are trained, in part by the NPS, they are able to instruct visitors to observe wildlife in a way that minimizes more energetic behavioral responses, for instance, by limiting interaction time and maintaining an appropriate distance from wildlife groups (NPS 2008a).

Studies have examined the reactions of bison to OSV users in the park over recent years. White et al. (2008) and Borkowski et al. (2006) reported that OSV use caused active movement responses in less than 10% of individual bison observed; 80% showed no apparent response. Behavioral monitoring from winter 1999 to winter 2009 indicates that bison demonstrated no visible response to OSVs 85% of the time, with active responses, including travel, alarm-attention, and flight, observed during about 3% of interactions. “Look-resume” vigilance responses composed the remaining 11% of visible responses (McClure et al. 2009). This indicates that the vast majority of bison in winter 2009 appeared undisturbed by OSV users, with minimal energetic responses.

Few studies have looked specifically at the population-level effects of winter use on distribution patterns of elk, bison, and wolves (Messer et al. 2009; Smith et al. 2007; Bruggeman et al. 2009a). White et al. (2008) report that human disturbance associated with OSVs did not appear to be the primary factor influencing the distribution or movement of bison, and concluded that individual responses that resulted in flight or other active behavior were apparently short-term behavioral responses and did not have lasting influence on the pattern of bison distribution. The data suggest that individual bison are sometimes disturbed by winter use in the park as indicated by movement responses 8% to 10% of the time, and look-resume response behavior. Based on monitoring, these individual-level disturbances have not affected natural abundances, diversities, dynamics, distributions, or behaviors of populations (Bruggeman et al. 2006; Borkowski et al. 2006; White et al. 2006; White et al. 2008; Plumb et al. 2009).

Bison Use of Groomed Roads on Bison Range Expansion and Population Growth

Historically, the bison winter range included the Lamar Valley, Pelican Valley and Mary Mountain (Meagher 1970, 1973). Over time, bison use of the northern and western regions of the range gradually increased, roughly correlating with the start of OSV use and trail grooming in 1971. In 1980, bison were first observed using a packed road surface to travel west of Pelican Valley (Meagher 1998). Since then, bison were often observed traveling along groomed road corridors, and air surveys observed bison using road corridors in traveling out of the park (Meagher 1998). Bison use of the Madison headwaters region between Old Faithful, West Yellowstone, and Mammoth occurs where road grooming and OSV travel by winter visitors is concentrated.

Bison use of the Madison headwaters region between Old Faithful, West Yellowstone, and Mammoth occurs where road grooming and oversnow travel by winter visitors is concentrated.

Meagher suggested that groomed roads directly contribute to an increased bison population and observed changes in bison range distribution by providing energy-efficient travel corridors. Meagher asserts that bison selectively choose to travel on groomed roads because the roads are packed and easier to travel on, and that bison traveling on roads save energy. Meagher hypothesizes that this has resulted in bison population growing to higher levels and at a faster rate than they would have in the absence of groomed roads, thus altering bison distribution in Yellowstone. Meager argues that road use by bison is particularly important during stress-induced, exploratory dispersal. Based on research observation, Meagher believes that the availability of groomed routes may influence whether bison travel and may direct bison movements by providing an energy efficient route of travel (Meagher 1989, 1993, 1998. (See also discussions of Meagher's research in NPS 2000b:143-147, 2003d:117-120, 2004a:80-81.)

Recent publications assert that road grooming is less important to population dynamics than other natural factors (Gates et al. 2005; Bruggeman et al. 2009b). These scientists found no correlation between the presence of groomed trails and increased bison movements, and did not find sufficient evidence that groomed roads provided an energy-efficient travel corridor (Cheville et al. 1998; Wagner 2006). Instead, the publications attribute bison population growth to a natural increase in population following the cessation of active culling and management by the NPS. As population density increased, bison traveled outside the historical central range in search of forage, due to the limited availability of forage in their historic ranges in Hayden and Pelican valleys, in the interior of the park. The requirement for increased nutritional intake due to higher population density and bison's innate ability to travel through deep snow, resulted in necessary range expansion, in search of new foraging areas, and migration westward to the Madison headwaters (Bjornlie and Garrott 2001; Gates et al. 2005; Bruggeman et al. 2009a, 2009b; Plumb et al. 2009). Also, pulses of winter bison movements from the central to northern parts of the park may have started in 1982 (Coughenour 2005; Fuller et al. 2007), but these movements became more common and included greater numbers of bison after 1996 (NPS 2008a).

Meagher's 1993, 1998, and 2001 articles and Coughenour's 2005 report suggest that over time, OSVs and groomed trail corridors may have made small contributions to the western migration trends of the central herd bison. Most researchers conclude that the changes in bison movement and range over the last 20 years are primarily in response to population-level dynamics (Gates et al. 2005; Fuller et al. 2007; Coughenour 2005; Taper et al. 2000; Plumb et al. 2009). These changes have resulted in movement from the central interior portions of Yellowstone to the northern and western portions of the park, regardless of winter use occurring in Yellowstone's central region (Gates et al. 2005; Fuller et al. 2007; Coughenour 2005; NPS 2008a).

In summary, the best available evidence regarding road grooming and bison distribution suggests the following. First, observed changes in bison distribution were likely consequences of natural population growth and range expansion that would have occurred regardless of the presence of snow-packed roads (Bjornlie and Garrott 2001; Coughenour 2005; Gates et al. 2005; Bruggeman et al. 2009a). Second, road grooming did not change the population growth rates of bison relative to what may have been realized in the absence of road grooming (Gates et al. 2005; Bruggeman et al. 2006; Fuller 2006; Wagner 2006). Third, there is no evidence that bison preferentially used groomed road during winter (Bjornlie and Garrott 2001; Bruggeman et al. 2006). Fourth, road segments used for travel corridors appeared to be overlaid on what were likely natural travel pathways, including narrow canyons and stream corridors (Gates et al. 2005; Bruggeman et al. 2009b). And fifth, bison use of travel corridors that include certain road segments would likely persist whether or not the roads were groomed (Gates et al. 2005; Bruggeman et al. 2009a).

Data on the bison population and their movements in the Yellowstone area prior to extensive hunting by humans and in the absence of OSVs are unavailable. Therefore, the vast majority of detailed information on bison was collected during the recent population expansion and in the presence of road grooming. Because bison now migrate to lower ranges for improved forage, it is impossible to determine after the fact, and in the absence of a control population, what precise impact, if any, road grooming and winter use has on bison winter range expansion and population growth (Bruggeman et al. 2007, 2009a).

ELK (*CERVUS ELAPHUS*)

Elk were nearly extirpated from North America by the early 1900s, due to human hunting, competition with domestic grazing animals, and habitat shift and loss (Clark 1999).

Elk were nearly extirpated from North America by the early 1900s, due to human hunting, competition with domestic grazing animals, and habitat shift and loss (Clark 1999). Most of the surviving elk in North America found refuge in the greater Yellowstone area due, in part, to strict hunting regulations and enforcement in the park after 1886. Elk herd summer ranges are found throughout Yellowstone (Clark 1999). Although populations have fluctuated between 20,000 and 30,000, since 1980 populations have dropped. This is likely due to predation by grizzly bears and wolves, regulated human harvest of un-antlered elk north of park boundaries that has historically taken up to 10% of the herd annually, mortality during the harsh winter of 1997, and drought effects on pregnancy and survival (Vucetich et al. 2005; White and Garrott 2005; Eberhardt et al. 2007).

Historic and Current Park Management of Elk

Elk

More than 20,000 elk from seven to eight different herds summer in Yellowstone and up to 10,000 winter in the park, making elk the most abundant large mammal in Yellowstone. Another 50,000 to 60,000 elk inhabit the greater Yellowstone area, forming 10 to 12 separate herds. Elk choose habitat based on the correct mix of topography, weather, vegetation, and factors that reduce their vulnerability to predation. Grasses are the primary forage, followed by forb species and conifers (Clark 1999). Their summer range is extensive and is based primarily on vegetation productivity. Winter range is limited by lower elevation and snow depth and is much smaller. Elk depend on thermal areas with snow-free vegetation and shallow snow cover for winter habitat along the Madison, Firehole, and Gibbon rivers (Craighead et al. 1973). The Madison headwaters elk herd is especially dependent on these areas for overwinter survival (Ables and Ables 1987). Like bison, elk use geothermal sites extensively during the winter for forage, due to minimal or reduced snow cover.

Elk play an important role in the ecology of the Yellowstone area. Winter-death carcasses, young calves, and adults are an important food source for many key park species including bald eagles, wolverines, wolves, coyotes, and grizzly bears. Elk make up more than 90% of the diet of gray wolves. Newborn or young elk are often killed and consumed by grizzly bears (Swensen et al. 1986; Smith et al. 1998; Barber et al. 2005). Elk are the most abundant larger grazers in Yellowstone. Browsing by elk and the nitrogen deposits in elk droppings can affect vegetation productivity, location, and diversity, and soil fertility. Changes in elk abundance and distribution can alter plant and animal ecology, composition, and structure in Yellowstone.

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Elk in the non-migratory Madison headwaters herd are exposed to high levels of OSV use, but there is no indication of effects on the population. From 1968 to 2004, when winter visitors to the park expanded from just 5,000 to over 100,000, the Madison headwaters elk herd population remained around 500 animals (Garrott et al. 2009). Before the introduction of wolves to the park, female elk had a 90% annual survival rate, with healthy recruitment and high birth and survival rates of calves (Garrott et al. 2003).

Overall, elk range has remained stable throughout periods of OSV use in the park, and there is no evidence that elk populations and movements are affected by winter use. Elk are not observed to use groomed roads as travel corridors to the same extent as bison. However, as discussed previously in the recent research section, individual elk can occasionally be visibly bothered by OSV travel, demonstrated by increased attention/alert or active movement/fleeing (Hardy 2001; Bjornlie 2000; White et al. 2006). Studies reported in Borkowski et al. (2006) and White et al. (2008) indicate that 48% of individual elk had no apparent response to OSV use, 27%–32% exhibited a “look–resume” response, 12%–17% “alert,” 5%–6% “travel,” and 2% “flight.” Most interactions between OSV users and elk occur in the northern range, along the groomed road corridors used by OSVs. In this area, the primary winter range is along the Firehole, Gibbon, and Madison rivers between the Norris Geyser Basin, Old Faithful, and West

Yellowstone, Montana. Major areas of geothermal activity, including Midway, Norris, and Old Faithful, and many other smaller geothermal areas, produce ice-free rivers and pockets of snow-free forage, where bison and elk congregate throughout the winter (Borkowski et al. 2006).

There is some evidence that elk were displaced approximately 60 meters from roads with mostly unguided OSV-use during observations from winter 1998 to winter 2001 (Hardy 2001; NPS 2008a). Observations of behavioral responses and apparent avoidance of humans in the vicinity of the roads were short-term changes and did not have a lasting influence on species distribution patterns.

CANADA LYNX (*LYNX CANADENSIS*)

Canada lynx once ranged throughout the boreal forests of North America from Alaska to Canada and into the northern United States. Below the Canadian border, lynx are listed in 14 states that support boreal forest types and have verified records of lynx occurrence: Colorado, Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Utah, Vermont, Washington, Wisconsin, and Wyoming (Yellowstone) (USFWS 2005). Based on declining populations and continuing threats from logging, recreation and development to their remaining habitat, Canada lynx were listed as threatened in the lower 48 states in March 2000 (USFWS 2005).

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Lynx are rarely found in Yellowstone and accurate historical population records are limited. Potential habitat for lynx is shown in figure 8. A total of 73 lynx sightings or tracks were reported in Yellowstone from 1887 to 1993, but the reliability of such reports is not guaranteed (Yellowstone National Park files; Consolo-Murphy and Meager 1995). A survey conducted from 2001 to 2004 for lynx in Yellowstone National Park found DNA and track evidence for three lynx, a female and two kittens, all east of Yellowstone Lake (Murphy et al. 2005; Murphy et al. 2006). This area also contained the highest indices of abundance for snowshoe hare and red squirrel, which form a large percentage of lynx diets (Koehler and Aubry 1994; Sunquist and Sunquist 2002). The authors note that lynx in other areas of the park could have escaped detection, but state that based on their data, they believe that lynx are primarily found in the east sector of the park. Lynx are also occasionally sighted in other areas of the park. Lynx were spotted at Indian Creek (just south of Mammoth) and in the Beryl Springs area (between Norris and Madison). Both times, the lynx were traveling near a snow road.

FIGURE 8: LYNX HABITAT IN YELLOWSTONE NATIONAL PARK

Data on lynx-human encounters suggest that lynx are generally tolerant of continued human presence, human scent, disturbance, and agricultural or housing development (Brand and Keith 1979; Fortin and Huot 1995; Staples 1995; Aubry et al. 1999). Mowat et al. (1999) states that based on their observations and research, lynx in Canada and Alaska likely tolerate moderate levels of snowmobile traffic throughout their winter ranges, readily cross highways, and appear comfortable near roads. However, Apps (1999) reports that lynx in the southern parts of their range, including the lower 48 states, are generally more sensitive to road fragmentation of habitat due to the relative scarcity of ideal habitat and reduced prey availability compared to that available to lynx the boreal forests of Canada and Alaska. Observations in Washington found that logging and U.S. Forest Service roads that were little used in the summer but frequently used by snowmobiles in the winter and roads less than 15 meters wide did not appear to affect lynx movements or habitat use (Koehler and Brittel 1990; McKelvey et al. 1999). While these little-used roads do not appear to affect lynx, research in the southern Canadian Rockies indicates that wider, more heavily used paved roads may influence lynx spatial organization, and lynx appear to avoid crossing highways (Apps 1999). Thus, lynx movements in the lower 48 states may be restricted by roads and highways due to direct avoidance of roads and habitat alteration and fragmentation. Ruediger (1996 unpublished report) found that traffic volumes were also a factor and volumes must generally exceed 2,000 to 3,000 vehicles a day in order for lynx to be affected. Many lynx are reported to have been killed by automobiles in other parts of the country and in Canada (Brocke et al. 1992; Weaver 1993; Staples 1995; Gibeau and Heuer 1996; Halfpenny et al. 1999; Murphy et al. 2006). There have been no reported lynx strikes in the greater Yellowstone area as of 2003 (Murphy et al. 2006). Thus, wide paved roads and those with higher traffic volume appear to have the most influence on lynx movements and habitat use.

Groomed trails alone also may affect lynx dispersion and predator-prey dynamics in lynx habitat. Groomed trails may facilitate access to lynx habitat by competing predators such as coyotes. Bunnell et al. (2006) used observations of coyote tracks from two field studies and found a strong association between coyote movements and OSV routes in deep snow areas. In contrast, Kolbe et al. (2007) found that coyote trails were generally associated with firmer snow conditions but not necessarily with compacted OSV trails. They also found snowshoe hare to be a rare component of the coyote winter diet. Both authors found that lynx show a greater preference for higher elevations than coyotes. This also indicates that they prefer areas of the park not subject to winter use, because most OSV routes, except the Sylvan Pass area, occur at lower elevations in the park.

Due to lynx range distribution, there have been fewer studies on lynx inhabiting the lower 48 states and in the southern part of their range, than on lynx in the boreal forests of Canada and Alaska. Studies conducted on the Rocky Mountain lynx populations have found that lynx may avoid crossing highways, avoid areas of human presence, and may use roads as territory boundaries (Apps 1999). Lynx do not appear to avoid crossing logging roads, or roads with lower levels of vehicle use (Koehler and Brittel 1990, McKelvey et al. 1999). Lynx may also be affected by human facilitation of access to their habitat by competing predators (or predators that may prey upon lynx) (Koehler and Aubry 1994). Lynx habitat in Yellowstone is likely limited to the east sector of the park, crossed by only one lightly used OSV snow road (with fewer than 10 OSVs per day, on average). The presence of kittens and the two recent sightings of lynx next to snow roads in other areas of the park indicate that lynx are likely traveling in and out of this area, particularly during breeding and dispersal. Traveling lynx would likely encounter groomed winter trails, and OSVs and humans traveling these trails, both within and outside the park, and their movements and ability to disperse could be adversely affected by OSV-associated noise and human presence on these groomed snow roads. Groomed roads make up very little of the total land area in Yellowstone and not all summer use roads are plowed or groomed in Yellowstone in the winter, so the amount of exposure to groomed trails would be small. Because of the secretive nature of lynx, their rarity, and their use of heavily forested habitat, few ecological studies have been conducted on lynx, and even fewer researchers have looked into the effects of winter recreation on this species. Therefore, it is difficult to determine how OSV use in Yellowstone would affect lynx habitat use, behavior, or distribution. Most of the park does not contain suitable habitat for lynx, and thus the majority of lynx that would encounter heavily used groomed trails and OSVs in the north-central area of the park would be traveling from one area of prime habitat to another for dispersal or breeding purposes. These travels are important to lynx ecology for genetic dispersion and habitat use. Lynx are mobile in the winter, and there is a potential for this species to encounter groomed roads and/or OSVs during their travels.

WOLVERINE (*GULO GULO*)

Until recently, wolverine populations in the lower 48 states were thought to be limited to the northern Cascade region of Washington and the Northern Rocky Mountain region in Idaho, Montana and Wyoming.

The wolverine is a rare and sparsely distributed member of the weasel family that inhabits remote areas of the circumpolar boreal forests. Even though wolverines only weigh from 6 to 18 kilograms, they are fierce predators and are able to successfully hunt large ungulates, including adult elk. Wolverines have rarely been studied by scientists (with a total of only about 25 publications worldwide) due in part to their scarcity, elusive behavior, and large home range size, as well as the inaccessible, rugged terrain they inhabit. As of 2001, there were six studies published on North American wolverines, with only two in the United States (Heinemeyer et al. 2001). Until recently, wolverine populations in the lower 48 states were thought to be limited to the northern Cascade region of Washington and the Northern Rocky Mountain region in Idaho, Montana, and Wyoming. However, scientists have now documented wolverines in California's Sierra Nevada Mountains and in Colorado's southern Rocky Mountains (USFWS 2010c). Due in part to the limited amount of information on wolverines, especially those living in the lower 48 states, and the recently observed populations in Colorado and California, the U.S. Fish and Wildlife Service (USFWS) initiated a status review of the North American wolverine population to determine whether this population should be listed as threatened or endangered under the Endangered Species Act (ESA). Currently, this potential listing determination remains under review (USFWS 2010c).

Wolverines rely on carrion as a food source but are also known to prey on large ungulates (Magoun 1983), and snowshoe hare and ground squirrel in areas of Alaska and the Yukon (Gardner 1985; Banci 1987). In the Yellowstone area, researchers found that wolverines primarily fed on ungulate carcasses, including elk, moose, and deer (Packila et al. 2007a). During winter, wolverines generally scavenge carcasses of adults, whereas in the spring they take young or newborn calves. Marmots and ungulates are consumed during late spring and summer. These prey items are supplemented with small mammals and birds. Some researchers suggest that year-round food supply is an important consideration for den location (Banci and Harestad 1990). Sylvan Pass is the closest known location of a wolverine to an OSV corridor and also contains suitable denning habitat. Wolverine tracks were seen on Sylvan Pass during the winter of 2009 (Sacklin, pers. comm., 2010).

The Abrasoka-Beartooth Wolverine Project was initiated in 2005 in collaboration with the NPS, to research wolverine ecology and provide a baseline for future research on wolverine ecology in the greater Yellowstone area. To date, four wolverines have been captured during intensive trapping efforts. Two wolverines were trapped and radio collared in the winter of 2006, one near Sylvan Pass. The closest preferred denning habitat to an OSV corridor in this area occurs at the pass itself (Landa et al. 1998; Banci and Harestad 1990). In the winter of 2007, researchers trapped two young wolverines, both north of Yellowstone. One additional wolverine was captured during winter 2008, and none were captured during winter 2009. The movements of those that were captured were tracked. One wolverine's home range was in the southeast corner of the park, and another overlapped this same area, with it home range also extending southwest of park boundaries. The two other wolverine home ranges were respectively north and south of park boundaries (Abrasoka-Beartooth Wolverine Project newsletter Spring 2009, 2008, 2007, 2006, available at http://www.wolverinefoundation.org/research/absaroka.htm).

The Greater Yellowstone Wolverine Program, established by the Wildlife Conservation Society (WCS), has conducted extensive research on wolverines in the greater Yellowstone area, with good capture success. During extensive trapping efforts from 2001 to 2007, 28 wolverines were captured and fitted with GPS collars. Preliminary research results show that, of the collared wolverines, male wolverines had an average home range size of 1,160 square kilometers, and female wolverines had an average home range size of 453 square kilometers. Of the 28 wolverines captured and collared, 17 were females. Females give birth in mid-February to only 1 kit every 2.5 years. Seven females denned up and gave birth to young, with 6 using designated wilderness areas; one den was in Yellowstone. One female's natal den was in an area that was occasionally subject to snowmobile activity. Dens were at high elevation (7,200 to 9,300 feet), and usually found within areas of avalanche debris, at subalpine sites near timberline, and among boulder talus. The birthing dens were occupied until late April. Young wolverines dispersed from their mother's home range when they are about a year old. Over three winters, eight wolverines (five females, three males) were captured and fitted with collars that recorded continuous activity levels during the winter. Male activity peaked in the morning and evening, whereas non-reproductive female activity peaked during morning. The reproductive female showed little activity for two weeks following the birth of her kit. The wolverines inhabited areas with varying levels of OSV use (McCue et al. 2007, unpublished data). Yellowstone OSV use peaks in the morning, early afternoon, and late afternoon, likely corresponding with active periods for wolverines.

The WCS also conducted research on wolverine road crossing patterns and occurrence in Greater Yellowstone, focusing on a crossing near the Henry Lakes Range at Earthquake Lake (US287) and Raynolds Pass (ID/MT87) west of Yellowstone National Park. The results demonstrate that wolverines cross roads to navigate their home ranges, and that linkage of home ranges via road crossing (and very likely snowmobile trail crossing) is critical to the maintenance of the greater Yellowstone area wolverine population (Packila et al. 2007b unpublished).

Wolverines tend to avoid humans. Human disturbance in the vicinity of a natal den may cause the wolverine to abandon her den for a less desirable den site, possibly resulting in reduced reproductive success (Banci 1994). This behavior has been observed in wolverines subject to human disturbance in both Norway (Myrberget 1968) and Finland (Pullianian 1968). Wolverines also appear to avoid areas of human activity for den choice, including areas of OSV use, because aerial surveys in the greater Yellowstone area in 2001 noted few wolverine tracks or foraging evidence in areas of heavy snowmobile use. Due to lack of any apparent habituation of the animals in the Yellowstone region, as inferred by the general elusiveness of the animals, rarity of sightings, and GPS tracking studies that indicate wolverines avoid roads, and areas of human development (Wildlife Conservation Society 2008), it can be inferred that human presence and sounds during the winter are generally negative for wolverines. The effects of OSV use in the park and the greater Yellowstone area on individual behavior and overall population are unknown, due to lack of long-term data and difficulty in observing or tracking individuals.

TRUMPETER SWAN (*CYGNUS BUCCINATOR*)

Hunted to near extinction in the early 1900s, trumpeter swans benefited from protections through the passage of the Migratory Bird Treaty Act in 1918 that helped reduce illegal hunting of trumpeter swans; however, habitat changes and hunting continued to reduce swan numbers. The tri-state area (Wyoming, Idaho, and Montana) flock of trumpeter swans was petitioned for listing under the ESA in 2003, but the USFWS did not find enough evidence for listing. Currently, the greater Yellowstone area population of swans is again under review for listing due to recent declines in the region (USFWS 2010d).

The park has both a resident population and a migratory winter population. Migrants that visit Yellowstone in the winter are a combination of swans from the Yellowstone/greater Yellowstone area and swans from Canada (primarily Grande Prairie, Alberta; Proffitt et al. 2009). The resident population in the park numbers about 14 swans, with fall migratory populations numbering as high as 500. Resident trumpeter swans display strong site fidelity to breeding areas and nest sites, and winter habitat is generally associated with areas of ice-free, open water (Baril et al. 2010). The winter habitat of swans and eagles is shown in figure 9.

The resident Yellowstone trumpeter swan population is considered at risk, due to decreasing numbers of swans and cygnets from 1961 to present. Population numbers are currently so low in the park that any area with a nesting pair could be closed to the public until August 15, after the critical rearing stage has passed (Baril and Smith 2009). Surveys in 2009 counted 144 swans during midwinter, and 4 adults and no cygnets in autumn. This is the lowest number of swans documented in the park since 2000, and indicates a 73% decline in population over the last nine seasons (2001 is excluded; Proffitt et al. 2009). Proffitt et al. (2009) report that the estimated abundance of resident trumpeter swans in the park has ranged from 59 individuals in 1968 to a low of 10 in 2007. Studies suggest that actions outside of the park, including supplemental feeding programs and draining of wetlands, caused decreases in the resident swan population. Density-dependent factors including competition with either migratory or resident swans did not appear to affect population dynamics of resident swans. Instead, growth rates decreased following severe winters, wetter springs, and warmer summers. The decrease in Yellowstone's resident swan population, therefore, appears to be highly dependent on actions outside the park (Proffitt et al. 2009).

During the breeding season, two nesting pairs of resident swans were found, but neither successfully produced young. Only two nesting pairs were observed over the past three seasons. Since 2001, there were at most four annual nesting attempts by trumpeter swan pairs in the park. More than 53% of nest attempts failed to raise any young, which researches attribute to predation and early season flooding (Proffitt et al. 2009). Overall, the attempts of resident swans to nest in the park have declined since 1987, but numbers have fallen even more steeply over the last decade (Baril and Smith 2009).

During the breeding season, two nesting pairs of resident swans were found, but neither successfully produced young. Only two nesting pairs were observed over the past three seasons. Since 2001, there were at most four annual nesting attempts by trumpeter swan pairs in the park.

Swans have also been the subject of study regarding reactions to OSV presence, with results indicating that human disturbance did not appear to be a primary factor influencing the distribution or movement of swans. White et al. (2006, 2008) report on the results of winter monitoring that occurred in the park from 2002 to 2006. Trumpeter swan responses to OSVs were characterized as 57% "no apparent response," 21% "look-resume," 12% "alert," 9% "travel," and 1% "flight." In 2009 winter wildlife monitoring (McClure et al. 2009), 80% of trumpeter swans had no reaction to OSVs, 11% responded with "look-resume," 8% " travel," and 0.5% "alarm-attention." No swans had a flight response. As with other species, odds of a reaction increased with variables including time of interaction, distance to road, and human behavior (McClure et al. 2009). Because nesting pairs may be extremely sensitive to human disturbance, park researchers recommend that nesting areas remain closed from April 30 to August 15 in order to allow time for cygnets to mature. This does not overlap with the winter-use season.

FIGURE 9: EAGLE AND SWAN WINTER HABITAT

It is also unlikely that poor production across the greater Yellowstone area has resulted from OSV use in the park. Swans generally return to their breeding territories between February and late May, with young hatching in late June when OSV is no longer a presence in greater Yellowstone area parks (Stalmaster and Kaiser 1998; Steidl and Anthony 2000; Gonzalez et al. 2006; Olliff et al. 1999) (NPS 2008a). A site along the Madison River, less than 100 meters from the park's heavily used west entrance road, has been a traditional swan nesting area for decades, and at least 23 cygnets have fledged from this site since 1983, making it one of the more productive nesting areas in the park. Researchers attribute the overall decline in the greater Yellowstone area to drought and wetland loss, low immigration rates, predation, and competition with other migrants, particularly snow geese (Baril and Smith 2009).

The resident Yellowstone trumpeter swan population is considered at risk, due to decreasing numbers of swans and cygnets from 1961 to present.

BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*)

Since their federal listing as an endangered species in 1967, bald eagle populations in the lower 48 states have increased dramatically, with nesting territories recorded in nearly every state. As a result, this species was removed from the Endangered Species List in August 2007, but protection for bald eagles remains in place under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

The park has a substantial resident population of eagles that may migrate short distances in winter to be near open water. This population expands seasonally with the addition of migratory eagles. Bald eagles are found in Yellowstone throughout the year, nesting in large trees generally near open water (Stangl 1999; Swensen et al. 1986; Alt 1980). Bald eagle winter habitat is usually near areas of unfrozen rivers or lakes, which provide access to freshwater fish. Winter habitat for eagles is shown in figure 9. Bald eagles also feed on carrion, upland small game species, and waterfowl. Nest building occurs between October and April, with actual nesting beginning in mid-February. Incubation occurs for 35 days, with hatching taking place in late March. In 2007, the park had 34 nesting pairs of bald eagles, which produced 26 eaglets, with 19 nesting pairs producing 7 eaglets in 2008 (Baril and Smith 2009). Bald eagle surveys in 2009 found 15 occupied eagle nests, 40% of which successfully fledged a total of 8 eaglets. The numbers of nesting and fledging bald eagles in the park increased incrementally from 1987 to 2005, but were not significantly correlated with cumulative winter visitation (White et al. 2008; also see the Scientific Assessment of Yellowstone National Park Winter Use). The overall eagle population in the park has remained relatively stable; all 9 nests around Yellowstone Lake were unsuccessful in fledging any young in 2009, whereas the 6 nests in other areas of the park successfully reared a total of 8 eaglets. Surveyors attributed this to human disturbance, climate change, a reduction in cutthroat trout populations, and other unidentified variables (Baril et al. 2010). In 2009, productivity per nesting female (the number of young successfully fledged per nesting female), was 0.53, a decrease from the average productivity of nesting bald eagles in Yellowstone over 26 years, which was 0.68 young per nesting female (Baril et al. 2010). This 26-year average productivity is slightly lower than the 0.70 average productivity necessary to maintain a stable population in the park. Thus, bald eagle populations are likely to gradually decline (Baril et al. 2010).

The park has a substantial resident population of eagles that may migrate short distances in winter to be near open water. This population expands seasonally with the addition of migratory eagles.

Based on wildlife monitoring the NPS has performed in the park from winter 2002 to winter 2006 (White et al. 2008), bald eagle responses to OSVs and human activity were categorized as 17% "no response," 64% "look-resume," 9% "attention-alarm," 4% "travel," and 6% "flight." Annual monitoring reports from 2009 (McClure et al. 2009) recorded 58 total interactions between winter recreationists and eagles. Of these, 62% initiated no response from the eagles, 21% resulted in "look-resume," 9% in "travel," 5% in "alarm-attention," and 3% in "flight." The combined percentage of travel and flight, the most active responses, was lower (12%) than that recorded in 2008 (16%), while the percentage of no response increased from 59% in 2008 to 62% in 2009 (McClure et al. 2009).

Eagle Nesting in Yellowstone

White et al. (2008) concluded that human disturbance did not appear to be a primary factor influencing the distribution of movement of bald eagles and that individual responses that resulted in flight or other active behavior were apparently short term and without lasting influence on species distribution patterns. A pair of bald eagles nesting near the west entrance road, where OSV traffic routinely passed within 55 meters of the nest, successfully fledged young in 2001. Buffer areas of 400 to 800 meters have been recommended where watercraft or vehicles are not permitted to stop (Stalmaster and Kaiser 1998; Grubb et al. 2002; Gonzalez et al. 2006). Grand Teton maintains a 0.5 mile closure around all bald eagle nests from February 15 to August 15. In Yellowstone, this type of closure is difficult, because roads are often sited in steep canyons along the river courses where bald eagles nest and feed. Thus, Yellowstone manages bald eagle nest sites on a case-by-case basis. Additionally, during OSV use season, the park enforces a 400-meter no-stop buffer for all eagle nests (White et al. 2006).

White et al. (2008) concluded that human disturbance did not appear to be a primary factor influencing the distribution of movement of bald eagles and that individual responses that resulted in flight or other active behavior were apparently short-term and without lasting influence on species distribution patterns.

About one month of the eagle breeding and nesting period coincides with the OSV use season in the park, during which time nests are being prepared and eggs laid and incubated. The presence of OSVs during this month creates a small risk that birds displaced by noise or disruption might have less foraging time and be less successful in raising offspring due to increased energy expenditure for flight, decreased pair bonding and reduced nest building time, and possible poor incubation by disturbed eagles. There is no overlap or potential for disturbance from OSV use after chicks have hatched. Nesting success and numbers of fledgling bald eagles in Yellowstone increased during a period of intense OSV use (1987 to 2005) and were not correlated with cumulative OSV traffic.

GRAY WOLF (*CANIS LUPUS*)

During winter foraging, gray wolves typically frequent ungulate winter ranges, including the Yellowstone northern range, Hayden and Pelican valleys, Madison headwaters, upper Gallatin drainage, the North Fork of Shoshone basin, and the Clark's Fork River (Green et al. 1997).

Historically found throughout North America, gray wolves were extirpated from the Yellowstone area by the mid-1930s by hunters and trappers. Wolves were reintroduced into the park between 1995 and 1997 by the USFWS and today, wolves in the Yellowstone area are classified as a non-essential, experimental population by the USFWS, and per the ESA 10(j), are managed in Yellowstone as a threatened population. Wolves in the Yellowstone region primarily prey on elk, which made up 83% of their diet in 2009 (Smith et al. 2010). Moose, deer, pronghorn, and bison make up the bulk of the remainder of their diet (Phillips and Smith 1997; Smith et al. 2010). Wolves hunt ungulates year-round and feed on ungulate carcasses prior to denning and in early April, when the most carcasses are available (Green et al. 1997). During winter foraging, gray wolves typically frequent ungulate winter ranges, including the Yellowstone northern range, Hayden and Pelican valleys, Madison headwaters, upper Gallatin drainage, the North Fork of Shoshone Basin, and the Clark's Fork River (Green et al. 1997). Figure 10 shows the ranges of Yellowstone wolf packs.

Until 2003, wolf numbers in the park increased following reintroduction. Between 2003 and 2008, density-dependent natural factors, such as fighting between and within wolf packs resulting in wolf mortality, food stress, and mange, caused declines. As of 2009, researchers observed 98 wolves in the park, split into 14 packs with 6 breeding pairs. This is a decline of 23% from 124 wolves in 2008. Despite the decline, the number of breeding pairs did not change (6 in 2008 and 2009). In 2009, pack size ranged from 3 (Lava Creek and Canyon) to 17 (Gibbon Meadows) and averaged 7.1, down from the long-term average of 9.8 wolves/pack. The overall average number of pups/pack in early winter was 1.8 for all packs (including packs that failed to produce pups). For packs that did produce pups, the average was 3.8 pups/pack, also down compared to the long-term average of 4.0 pups/pack (Smith et al. 2010).

Winter researchers monitoring wildlife behavioral responses to OSVs have observed wolves only rarely in 6 years of monitoring, with a total of just 14 sightings as of 2009 that involved OSV-wolf interactions (less than 1% of total wildlife-OSV observations), with the majority of wolf responses consisting of look-resume or no visible response (McClure et al. 2009). Wolf tracks were frequently seen on the roads by winter wildlife monitoring crews, and wolves have been documented traveling and making nocturnal kills during winter in developed areas of the park. After reintroduction, wolves quickly became a showcase animal in the Lamar Valley, readily visible from the wheeled vehicle route, and attracting visitors just for the purpose of wolf watching. Wolf distribution does not appear to be affected by human recreation in the park (Smith et al. 2005; Smith et al. 2007), but no studies have looked specifically at the population-level effects of winter use on distribution patterns, or at associated behavioral implications. Wolves den in April, after the winter use season has ended (Smith et al. 2010).

Creel et al. (2002), reporting on studies of wolves in Yellowstone, Voyagers, and Isle Royale national parks in 1999 and 2000, found that increased stress hormone levels, and therefore physiological stress, were correlated to OSV usage on short and annual scales. Several other researchers have found that prolonged GC elevation typically results in reduced survival and reproduction among both humans and captive animals (Munck et al. 1984; Sapolsky 1994). Creel et al. (2002) state that despite higher stress hormone levels, they found "no evidence that current levels of snowmobile activity are affecting the population dynamics of [wolves] in these locations." However, their research did detect "a clear physiological stress response induced by the current level of snowmobile activity" in the population of elk and wolves they sampled during their research. It should be noted that OSV use has dropped by about two-thirds since these studies were completed (Sacklin, pers. comm., 2010).

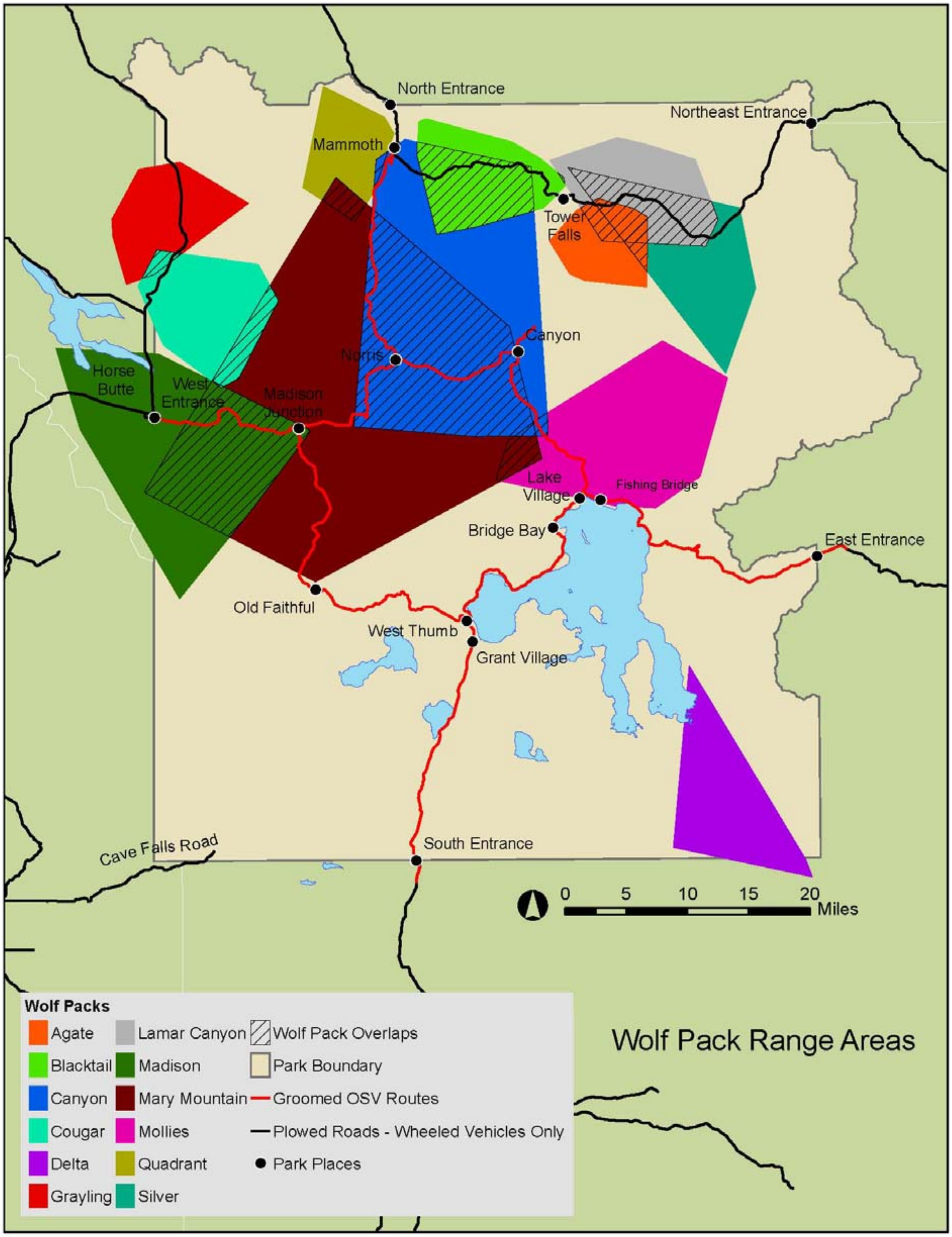


FIGURE 10: WOLF PACK RANGES IN YELLOWSTONE NATIONAL PARK

Human use of roads and avoidance of these areas by wolves may adversely affect wolf hunting success. Wolf hunting success data finds that wolves are more likely to successfully bring down an elk in areas that are flat, open, and near roads (Creel and Winnie 2005). Such data suggest that avoidance of such areas by wolves during the day due to OSV use may limit their hunting success.

Wolves in Yellowstone have an ample prey base for food supply, and wolves in and around Yellowstone rarely pose a threat to humans or demonstrate begging behaviors.

Habituation by wolves may occur if they are fed or exposed to human food or trash or human activity. Wolves in Yellowstone have an ample prey base for food supply, and wolves in and around Yellowstone rarely pose a threat to humans or demonstrate begging behaviors. Wolves frequenting areas of human use or development or wolves that are observed approaching people are hazed by the park staff, generally with bean-bag bullets. In 2009, the four-member Canyon wolf pack was successfully hazed away from a denning site near Mammoth Hot Springs. Although the pack did not approach humans for food and did not appear to be human food conditioned, the amount of human use in the area and potential for negative interactions between wolves and visitors was a safety concern. After hazing, the pack moved on to its summer range in Hayden Valley. During the previous summer, prior to the hazing events of spring 2009, the wolves had approached vehicles, and were frequently observed traveling on the Hayden Valley road. During the summer of 2009, following hazing, such behaviors were no longer demonstrated by the Canyon wolf pack. The success of hazing with this pack and of other wolf hazing events in the park indicates that hazing is a successful strategy for habituated wolves and effectively stops unwanted behaviors (Smith et al. 2010).

Hazing generally has good success in eliminating unwanted behaviors or in moving wolves out of an area. But if wolves demonstrate threatening behavior or begging behaviors that indicate they are conditioned to expect handouts from people, hazing may not be successful or park managers may decide the threat posed by the wolf (or wolves) is too high, and the wolf (or wolves) must be removed (Smith et al. 2010). Guiding requirements, education on proper storage of food and behavior around wildlife, and limits on the total number of visitors per day decrease the development of habituation in park wolves due to winter use. Humans who feed or encourage wolves to approach, or who leave food scraps in places accessible to wolves, may cause wolves to become habituated, but in recent years, OSV associated visitors have not been cited as a problem. Wolves may habituate regardless of human behavior, due to frequent exposure to non-threatening humans. It appears that wolves generally avoid encounters with OSV users, and may preferentially choose to travel on OSV roads during times of low human activity (Smith et al. 2008, 2009, 2010).

AIR QUALITY

Air quality is protected under several provisions of the Clean Air Act (CAA), including the Prevention of Significant Deterioration (PSD) program and the national ambient air quality standards (NAAQS). These regulatory requirements, as they relate to Yellowstone, are described in greater detail below.

PREVENTION OF SIGNIFICANT DETERIORATION

The CAA established the PSD program to protect air quality in relatively clean areas. One purpose of the PSD program is to protect public health and welfare, including natural resources, from adverse effects that might occur even though NAAQS are not violated. Another purpose is to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value (42 USC 7401 et seq.). In Yellowstone, the Baseline Year concentrations for PSD are based on the ratio of 1979 snowmobile levels at the modeling locations. Snowmobile traffic in the park increased from 1979 until the early 2000s when the PSD ratio increased, and then decreased to levels less than the late-1970s, while snowcoach travel steadily increased, almost doubling in 10 years, resulting in a PSD ratio decrease to less than 1 under the 2009 interim rule.

The PSD program includes a classification approach for controlling air pollution. Class I areas are afforded the greatest degree of air quality protection. Yellowstone National Park is classified as Class I area under the CAA PSD program. The PSD regulatory program generally consists of permitting and planning requirements to limit air quality deterioration and to prevent adverse impacts on Air Quality Related Values (AQRVs) in Class I areas. The AQRVs of the park are those resources that are potentially sensitive to air pollution and include visibility, water quality, soils, vegetation, and wildlife (NPS 2007a). A new major stationary pollution source proposing to locate near a Class I area must apply for a PSD permit from the appropriate regulatory agency, most often the state. The park superintendent, with technical assistance from the NPS Air Resources Division (ARD), then reviews the permit proposal for potential adverse impacts to park resources and provides comments to the permitting authority regarding permit conditions and approval of air pollution emissions from that source (NPS 2011).

The air quality analysis supporting a PSD permit application must analyze the impact of the proposed major source of emissions in comparison to PSD increments. A PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is the ambient concentration existing at the time that the first complete PSD permit application affecting the area is submitted. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable PSD increment (EPA 2009d).

Even if the PSD increment is not exceeded, no PSD permit can be issued if the he federal land manager (in this case NPS) determines that the source of the emission will adversely affect the Class I area's AQRVs. Similarly, if the PSD increment is exceeded, but the federal land manager certifies that the source will not adversely affect the Class I area's AQRVs, a PSD permit can be issued (NPS 2011). The Federal Land Managers' Air Quality Related Values Work Group (FLAG) was formed to provide a consistent and objective approach to determining if a proposed emission source would have an adverse impact on AQRVs in a Class I area. The FLAG 2010 Phase I report describes the methodology and impact criteria for assessing AQRVs, including visibility (NPS 2010b).

NATIONAL AMBIENT AIR QUALITY STANDARDS

NAAQS requirements were established to protect human health and the environment and to serve as ceilings for acceptable maximum air quality concentrations (Hawkins and Ternes 2004). The NAAQS consist of numerical standards for air pollution, which are broken into "primary" and "secondary" standards for six major air pollutants:

- **Carbon monoxide (CO)**—Carbon monoxide is a colorless, odorless gas (EPA 2010a) produced by the incomplete burning of carbon in fuels (EPA 2009a). It is toxic to mammals because of its strong tendency to combine with hemoglobin to form carboxyhemoglobin, which reduces the oxygen-carrying capacity of the blood. Because the hemoglobin that has combined with CO is no longer available to carry oxygen, delivery of oxygen to the body's organs and tissues is inhibited, resulting in adverse health effects (Ayres and Kornreich 2004). Health effects may include impairment of visual perception, manual dexterity, learning ability, and performance of complex tasks; headaches and fatigue; or respiratory failure and death (EPA 2009b, 2010a).
- **Nitrogen dioxide (NO_2)**—Nitrogen dioxide has a strong, harsh odor and is a liquid at room temperature, becoming a reddish-brown gas at temperatures above 70°F. Nitrogen oxides (NO_x) are released into the air from the exhaust of motor vehicles; the burning of coal, oil, or natural

gas; and during other industrial and manufacturing processes. In addition, NO_2 reacts with sunlight leading to the formation of ozone and smog conditions in the air (ATSDR 2002). Evidence suggests that short-term exposure to NO_2 may result in adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma. Emissions control measures leading to reductions in NO_2 can generally be expected to reduce population exposures to all gaseous nitrogen oxides, which may have the co-benefit of reducing the formation of ozone and fine particles both of which pose significant health threats (EPA 2009c).

- **Ozone (O_3)**—Ozone is a colorless and odorless (in low concentrations) gas that is found in both the upper atmosphere (10 to 30 miles above the earth's surface) and at ground level. It is not usually emitted directly into the air, but at ground level is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight (EPA 2010b). Inhaling ground-level ozone can result in a number of health effects: induction of respiratory symptoms including coughing, throat irritation, pain and discomfort in the chest, chest tightness, and shortness of breath; decreased lung function; and inflammation of airways. Exposure occurs when people inhale ambient air containing ozone, and people with the greatest exposure are those heavily exercising outdoors for long periods of time when ozone concentrations are high (EPA 2010c).
- **Particulate matter (PM)**—Particle pollution, or PM, is the term for a mixture of solid particles and liquid droplets found in the air (EPA 2010d). Particles that are less than 2.5 micrometers in diameter are known as "fine particles" ($PM_{2.5}$); those larger than 2.5 micrometers, but less than 10 micrometers, are known as "inhalable coarse particles" (PM_{10}) (EPA 2010d). Particulate pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles (EPA 2010e) from sources such as power plants, vehicles, construction activity, fires, and windblown dust. PM can either be emitted directly from such sources or formed in the atmosphere through secondary reactions or condensation (EPA 2010d). Health effects from PM emissions include reduced lung function, the development or aggravation of respiratory problems, irregular heartbeat, non-fatal heart attacks, and premature death in people with heart or lung disease (EPA 2010f).
- **Sulfur dioxide (SO_2)**—Sulfur dioxide is one of a group of highly reactive gases known as "oxides of sulfur" (EPA 2010g). Sulfur dioxide in the air results primarily from activities associated with the burning of fossil fuels such as at power plants (ATSDR 1998) and other industrial facilities (EPA 2010g). Current scientific evidence links short-term exposures to SO_2, ranging from 5 minutes to 24 hours, with a variety of adverse respiratory effects including bronchoconstriction (tightening of the airway muscles in the lungs) and increased asthma symptoms (EPA 2009a). Annual ambient SO_2 concentrations have decreased by more than 70% since 1980 (EPA 2010h).
- **Lead**—Lead is a naturally occurring, bluish-gray metal found in small amounts in the earth's crust, but it can also be found in all parts of the environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing (ATSDR 2007). The largest source of lead in the atmosphere has been from leaded gasoline combustion, but with the phase out of lead in gasoline, air lead levels have decreased considerably. Lead is a toxic element, causing a variety of effects at low dose levels. Brain damage, kidney damage, and gastrointestinal distress in humans are seen from acute (short-term) exposure to high levels of lead in humans. Chronic (long-term) exposure to lead results in effects on blood, the central nervous system, blood pressure, kidneys, and vitamin D metabolism in humans (EPA 2010i).

Primary standards protect public health and represent levels at which there are no known major effects on human health. Secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment (EPA 2010j). These standards are detailed in table 14. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb – parts per 1,000,000,000) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$) (EPA 2010j).

TABLE 14: NATIONAL AND STATE (MONTANA) AMBIENT AIR QUALITY STANDARDS

Pollutant	Primary Standards			Secondary Standards		
	National Level	State Level	Averaging Time	National Level	State Level	Averaging Time
Carbon Monoxide	9 ppm ($10 mg/m^3$)	9 ppm	8-hour (1)	None		
	35 ppm ($40 mg/m^3$)	23 ppm	1-hour (1)			
Lead	$0.15 \mu g/m^3$ (2)	$1.5 \mu g/m^3$	Rolling 3-Month Average	Same as Primary		
	$1.5 \mu g/m^3$	—	Quarterly Average	Same as Primary		
Nitrogen Dioxide	53 ppb (3)	50 ppb	Annual (Arithmetic Average)	Same as Primary		
	100 ppb	300 ppb (1)	1-hour (4)	None		
Particulate Matter (PM_{10})	$150 \mu g/m^3$	$150 \mu g/m^3$	24-hour (5)	Same as Primary		
Particulate Matter ($PM_{2.5}$)	$15.0 \mu g/m^3$	—	Annual (6) (Arithmetic Average)	Same as Primary		
	$35 \mu g/m^3$	—	24-hour (7)	Same as Primary		
Ozone*	0.075 ppm (2008 std)	—	8-hour (8)	Same as Primary		
	0.08 ppm (1997 std)	—	8-hour (9)	Same as Primary		
	N/A	0.10 ppm (1)	1-hour	Same as Primary		
Sulfur Dioxide	0.03 ppm	0.02 ppm	Annual (Arithmetic Average)	0.5 ppm	—	3-hour (12)
	0.14 ppm (11)	0.10 ppm (1)	24-hour			
	75 ppb (10)	50 ppb	1-hour	None		

Source: EPA 2010j; Montana Department of Environmental Quality (MTDEQ) 2010a.

(1) Not to be exceeded more than once over any 12 consecutive months.

(2) Final rule signed October 15, 2008.

(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

(5) Not to be exceeded more than once per year on average over 3 years.

(6) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

(7) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

(8) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

(9) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(10) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

(11) Not to be exceeded more than once per calendar year.

*U.S. Environmental Protection Agency (EPA) is currently reconsidering the 8-hr ozone NAAQS set in 2008.

Yellowstone is in five counties—Park and Teton counties, Wyoming; Fremont County, Idaho; and Gallatin and Park counties, Montana. All are currently in attainment of the NAAQS (EPA 2010k). However, air pollutant emissions within a 186-mile (300-kilometer) radius of Yellowstone have the potential to affect air quality sensitive resources in the park. There are several counties within a 186-mile (300-kilometer) radius of the park currently designated in non-attainment for PM_{10}, SO_2, and/or lead NAAQS established by the EPA (EPA 2010k; NPS 2004b):

- Lewis and Clark County, Montana, in non-attainment for SO_2 and lead;
- Yellowstone County in non-attainment for SO_2; and
- Missoula (MT), Silver Bow (MT), Yellowstone (MT), Rosebud (MT), Power (ID), Bannock (ID), and Sheridan (WY) Counties in non-attainment for PM_{10}.

Pursuant to the CAA provisions, Wyoming and Montana have adopted air quality standards that are more stringent for some pollutants than provided in the NAAQS. While it is clear that the CAA delegates jurisdiction for enforcement of air quality standards to conforming states, it is equally clear that the act gives federal land managers the affirmative responsibility to protect air quality and AQRVs (including visibility). The federal land manager, in this case the NPS, has the authority and jurisdiction to administer some provisions of the CAA, particularly the non-degradation standard for Class I air, and to manage activities within their jurisdictions that either affect, or have the potential to affect, air quality or associated values.

AIR QUALITY AT YELLOWSTONE NATIONAL PARK

The climate in the area of Yellowstone is characterized by cold winters and mild to warm summers. During the winter months, the average daytime temperature ranges from zero to 20°F. Subzero overnight temperatures are common during the winter. The prevailing winds during the winter months are generally from the west and west-southwest (NPS 2009a; WRCC 2002). Annual snowfall averages near 150 inches; however, it is not uncommon for higher elevations to get twice that amount. In general, Yellowstone weather is unpredictable at all times of the year (ALL Trips n.d.; NPS 2010f). Air pollutant emissions can be transported long distances, eventually affecting air quality sensitive resources in parks hundreds of kilometers downwind of sources (NPS 2004b). The Wyoming Department of Environmental Quality is the governing authority for regulating air pollution from stationary sources in Wyoming. Because there is little industrial activity and a relatively low population in northwestern Wyoming, overall air quality in the park is good (NPS 1998a). Regional sources of air pollutants that could affect Yellowstone include electric utility power plants, oil and gas processing, coal bed methane wells, industrial fossil-fuel combustion, and agriculture. Local sources of air pollution include automobiles, snowmobiles, and wildland fires (NPS 2007a). As previously described, several counties within a 186-mile radius of the park are designated in non-attainment for PM_{10}, SO_2, and/or lead NAAQS as a result of various local and regional sources of air pollutants.

AIR QUALITY RELATED VALUES

As previously described, the AQRVs of Yellowstone include visibility, water quality, soils, vegetation, and wildlife. Visibility is a very sensitive AQRV at Yellowstone. Although visibility in the park is still superior to that in many parts of the country, visibility in the park is often impaired by haze (light-scattering pollutants). The EPA's regional haze regulations require states to establish goals for each Class I air quality area to improve visibility on the haziest days and ensure that no degradation occurs on the clearest days (NPS 2007a).

Secondary pollutants such as sulfates and nitrates, produced by industrial sources and automobile emissions, can result in the deterioration of visibility in park units and contribute to acid deposition, which leads to impacts in forests. Acid deposition occurs when acidic materials fall from the atmosphere to the Earth in either wet (rain, sleet, snow, fog) or dry (gases, particles) form. More commonly referred to as acid rain, acid deposition has two components: wet and dry deposition. The main chemical precursors leading to acidic conditions are atmospheric concentrations of SO_2 and NO_x. When these two compounds react with water, oxygen, carbon dioxide, and sunlight in the atmosphere, the result is sulfuric acid (H_2SO_4) and nitric acid (HNO_3), the primary agents of acid deposition (Ecological Society of America 2000). Although there are currently no standards for levels of sulfates or nitrates in ambient air, these pollutants may present a concern for ecosystem health in park units.

Certain headwater lakes in the park are potentially sensitive to atmospheric deposition (deposited material) of sulfur and nitrogen compounds because of their low acid neutralizing capacity. Their snowmelt-dominated hydrology makes them vulnerable to episodic acidification in the spring, and possibly chronic acidification. In addition, high-elevation soils may be poorly buffered and sensitive to acidification (NPS 2006b, 2007a).

Soils and vegetation in the park may be sensitive to nutrient enrichment from nitrogen deposition as well. In some parts of the country, including other high-elevation ecosystems in the Rocky Mountains, nitrogen deposition has altered soil nutrient cycling and vegetation species composition. Native plants that have evolved under nitrogen-poor conditions have been replaced by invasive species that are able to take advantage of increased nitrogen levels (NPS 2007a).

Wildlife is considered an AQRV at Yellowstone; however, there is currently no information indicating that wildlife species in the park are being affected by air pollutants (NPS 2006b).

Effects of OSVs on Air Quality Related Values

Based on the limited available data specific to OSVs, most potential ecosystem effects from OSV use are negligible. Atmospheric and snowpack concentrations of OSV emitted pollutants have decreased in response to best available technology (BAT) implementation, and it appears that current emission levels from OSVs likely do not compromise ecosystem health in a measurable way. For a detailed review addressing the potential effects of OSV emissions on nitrate deposition, biota, soils, the snowpack, runoff and surface waterbodies, refer to the Scientific Assessment of Yellowstone National Park Winter Use.

AIR QUALITY CONDITIONS AND TRENDS

The NPS measures progress toward improving park air quality by examining trends for key air quality indicators, such as visibility, which affects how well and how far visitors can see; atmospheric deposition, which affects ecological health through acidification and fertilization of soil and surface waters; and ozone, which affects human health and native vegetation. The NPS monitors one or more of these indicators in 57 park units, including Yellowstone National Park, and there is sufficient data to assess conditions and trends in all of these parks. In addition, many state and local air quality monitoring stations are near enough to parks that the data they collect are considered reasonably representative of park air quality. Air quality trends provide one measure of performance and progress. In general, air quality that is improving, or showing no degrading trend, may be considered a sign of success. In accordance with the Government Performance and Results Act, the NPS has established performance goals based on air quality trends and reports annually on progress toward these goals (NPS 2009b). For fiscal year 2009, these goals are improving or not degrading visibility in 95% of NPS reporting parks; reducing and maintaining at current levels of ozone in 86% of NPS reporting parks; and reducing and maintaining at current levels of atmospheric deposition in 76% of NPS reporting parks (NPS 2010g).

In addition to determining the trends in air quality, the NPS is interested in assessing the condition of the air resources in NPS units, including Yellowstone. To assess conditions, the NPS ARD uses all available monitoring data collected from NPS, EPA, state, tribal, and local monitors over a 5-year period, to generate interpolations for the continental United States. These interpolations allow the ARD to derive estimates of the air quality parameters at all NPS units in the continental United States. The interpolation values are used to determine an index for each type of air quality data collected (visibility, ozone concentrations, and wet deposition) that assigns air quality to one of three condition categories (NPS 2010g): Air Quality is a Significant Concern, Air Quality is a Moderate Concern, Air Quality is a Good Concern.

Based on this air quality rating guidance published by ARD (NPS 2010g), the year-round air quality condition at Yellowstone is rated as a “significant concern” (or “degrading” trend) for nitrogen wet deposition (deposited nitrogen to the earth’s surface through precipitation). It is rated a “moderate concern” (or “stable” trend) for ozone, visibility, and sulfur wet deposition (deposited sulfur through precipitation) (NPS 2009b) (see table 15). However, it should be noted that the degrading trend for nitrogen wet deposition is due to regional sources and is not related to OSVs (the Scientific Assessment of Yellowstone National Park Winter Use). As noted previously in table 15, with the anticipated update to the EPA ozone standard, the air quality condition for ozone could to be revised to a “significant concern” in the foreseeable future (NPS 2010g). The stations where these trends are measured are not specifically related to winter OSV use; however, monitoring these key indicators provides a general overview of air quality conditions and trends at the park, which is valuable when assessing air quality as it relates to winter use.

TABLE 15: CONDITION OF AIR RESOURCES AT YELLOWSTONE NATIONAL PARK, 2003-2007

Air Quality Resource	Condition	Trend
Visibility[1]	Moderate Concern (Caution)	Stable
Nitrogen Wet Deposition[2]	Significant Concern	Degrading
Sulfur Wet Deposition[3]	Moderate Concern (Caution)	Stable
Ozone[4]	Moderate Concern (Caution)	Stable

Source: NPS 2009b.

[1] Condition assessments derived from interpolations of average visibility conditions, 2003-2007.

[2] Condition assessments derived from interpolations of nitrogen deposition in precipitation, 2003-2007.

[3] Condition assessments derived from interpolations of sulfur deposition in precipitation, 2003-2007.

[4] Condition assessments derived from interpolated values of the annual 4th-highest 8-hour ozone concentrations, 2003-2007.

In accordance with the Government Performance and Results Act, the NPS Strategic Plan established the following air quality goals to be met by 2012:

- Visibility in 95% of NPS reporting parks has remained stable or improved
- Atmospheric deposition in 79% of NPS reporting parks has remained stable or improved
- Ozone in 89% of NPS reporting parks has remained stable or improved.

Progress toward these goals is measured annually through target goals. Making progress toward meeting park air quality is challenging because although the NPS is given a consultation role under the CAA, it has no direct authority to control sources of pollution outside park boundaries. In order to achieve park air quality goals, the NPS works collaboratively with federal and state air regulatory agencies, as well as neighboring land management agencies, to enhance and protect air quality in the parks to the greatest extent possible (NPS 2009b).

GENERAL AIR QUALITY TRENDS RELATED TO OSV USE

By the late 1990s, an average of 795 snowmobiles entered the park each day, resulting in high levels of pollution from CO, PM and hydrocarbons. All snowmobiles at that time were two-stroke machines, which result in greater emissions of CO and PM than four-stroke machines. The 2000 Winter Use Plan FEIS proposed banning snowmobiles and only allowing cleaner and quieter snowcoaches (four-stroke snowmobiles were not available at the time). Subsequent winter use plans have proposed addressing impacts to air quality (among other issues) using a combination of new technologies, limits on vehicle numbers, mandatory guiding, and monitoring winter-use impacts on park resources (NPS 2010c). All documents proposed allowing a combination of snowmobiles and snowcoaches, with the snowmobile numbers decreasing from plan to plan and snowcoach numbers remaining consistent.

Despite numerous legal challenges, an important consequence of past winter use planning has been the implementation of snowmobile BAT requirements and entrance limits. The implementation of BAT requirements and reduction in the number of OSVs entering the park dramatically reduced CO, PM, and hydrocarbon emissions. Maximum 8-hour CO concentrations at Old Faithful have declined from 1.2 ppm in 2002/2003 to 0.4 ppm in 2007/2008. The 98th percentile $PM_{2.5}$ concentrations at Old Faithful have decreased from 21 $\mu g/m^3$ in 2002/2003 to 5.8 $\mu g/m^3$ in 2007/2008 (Ray 2008). In addition to BAT requirements and lower snowmobile numbers, improvements in air quality have been assisted by commercial guiding (which helps assure use of BAT and helps encourage idling to be kept to a minimum) and changes in entrance station procedures to prevent idling groups of snowmobiles.

The substantial CO and PM emissions reductions from requiring four-stroke snowmobiles have come with one important tradeoff—an increase in NO_x emissions. Four-stroke snowmobiles have higher NO_x emissions than two-stroke snowmobiles. Diesel snowcoaches have higher NO_x emissions than gasoline snowcoaches. Preliminary monitoring results for the 2009/2010 season indicate that NO_2 concentrations at the west entrance are slightly below 50% of the recently established 1-hour NO_2 standard of 0.100 ppm. The available monitoring data supports the conclusion that the park is compliance with the NAAQS for NO_2. There is an insufficient record of NO_2 monitoring data to draw firm conclusions about NO_2 concentration trends in the park at this time. NPS will continue NO_2 monitoring to better understand any trends in concentrations and the relationship between NO_2 concentrations and specific OSV types.

Additional monitoring will be needed to further characterize existing NO_2 concentrations in the park and ensure compliance with the standard.

Air Quality Monitoring in Yellowstone National Park

Air quality monitoring has occurred at Yellowstone since 1980 when the park initiated wet deposition monitoring as part of the National Atmosphere Deposition Program/National Trends Network. The site for wet deposition monitoring is at Tower Ranger Station. Dry deposition has been estimated for Yellowstone since 1996 as part of the Clean Air Status and Trends Networks (NPS 2006c). Additional air quality monitoring at the park includes the following:

Wet Deposition*— the process by which aerosol particles collect or deposit themselves on solid surfaces, decreasing the concentration of the particles in the air. Acid rain is one form of wet deposition.*

- **Air Atlas**—Air Atlas is a geographical information system database of air quality estimates for 270 parks that are part of the NPS Inventory and Monitoring Program. These estimates are often used when on-site monitoring data is not available (NPS 2006c).
- **Night Skies**—Dark night skies are considered an important AQRV at Yellowstone. Air pollution and poor quality outdoor lighting degrade night skies. Optical monitoring to collect baseline data on night sky brightness at the park was conducted in 2005. Optical measurements can produce not only a measure of night sky brightness and identification of light pollution sources, but also a measure of the effect of the atmosphere on light scattering caused by fine particulates and other air pollutants, as well as moisture (NPS 2006b, 2006c).
- **Mercury Monitoring**—Mercury in rainfall is monitored in the park as part of the Mercury Deposition Network, which was initiated in 2002 at Yellowstone. The monitoring site is at Tower Ranger Station. Both distant industrial sources and local geothermal sources contribute to mercury deposition in the park (NPS 2006c, 2007a).
- **Ozone Monitoring**—Ozone has been monitored with a continuous analyzer in the park since 1987. Data indicate that ozone concentrations and doses are not currently at levels known to cause injury to natural resources like vegetation, although no systematic surveys to assess vegetation injury have been performed in the park (NPS 2007a).
- **Visibility Monitoring**—As part of the Interagency Monitoring of Protected Visual Environments network, visual air quality in the park has been monitored since 1981 using a variety of methods, including an aerosol sampler, a transmissometer, a nephelometer, an automatic 35-mm camera, a digital camera, and a time-lapse video camera (NPS 2007a).

There are several air monitors within and in the immediate vicinity of Yellowstone. One network air quality station is near Yellowstone Lake maintenance facility on the north end of the lake, approximately ½ mile away from a moderately used OSV route (Site ID 560391011) (EPA 2009e; Ray 2008). The lake station measures ozone, meteorology, sulfate, nitrate, nitric acid, sulfur dioxide, and PM as part of the Clean Air Status and Trends Networks and Interagency Monitoring of Protected Visual Environments monitoring network. Another air quality station is near the Tower Ranger Station (near a wheeled vehicle road and 15 miles from the nearest OSV route), and measures wet deposition for mercury, sulfates, nitrates, and ammonium as part of the National Atmosphere Deposition Program/National Trends Network national deposition monitoring network (Ray 2008). Results for ozone monitoring at the Lake station are summarized in table 16, which presents a trend of general fluctuation in airborne concentrations of ozone that have remained below the current 8-hour NAAQS of 0.075 ppm and the Montana 1-hour standard of 0.1 ppm.

TABLE 16: RESULTS OF OZONE MONITORING AT YELLOWSTONE NATIONAL PARK, 1998–2008

Site ID	Location	County	Year	4th Highest 1-hour Max (ppm)	4th Highest 8-hour Max (ppm)
560391011	Yellowstone National Park	Teton County, Wyoming	1998	0.070	0.066
			1999	0.078	0.071
			2000	0.073	0.065
			2001	0.076	0.066
			2002	0.073	0.066
			2003	0.071	0.065
			2004	0.065	0.060
			2005	0.068	0.060
			2006	0.074	0.069
			2007	0.073	0.065
			2008	0.070	0.065

Source: EPA 2009e.

The EPA has data for $PM_{2.5}$ from 2003 to 2008 from one location in the park near the West Yellowstone Entrance Station (Site ID 300310013) and PM_{10} monitoring from 1998 to 2006 from one location in West Yellowstone, Montana (Site ID 300310012), outside the park boundary in the community of West Yellowstone. The monitoring site at the west entrance was established in 1998 to measure CO, and continuous $PM_{2.5}$ monitoring was added in 2003. The west entrance was moved about 0.25 mile further into the park in spring 2008, and the air quality monitoring station was similarly relocated (MTDEQ n.d.). Results for $PM_{2.5}$ and PM_{10} monitoring for the two stations are summarized in table 17, which presents a trend of general decline since 1998 in PM_{10} that has remained well below the current 24-hour standard of 150 $\mu g/m^3$. Results for $PM_{2.5}$ monitoring at the west entrance present a trend of considerable fluctuation since 2003; however, concentrations have remained well below the current 24-hour and annual standards of 35 $\mu g/m^3$ and 15 $\mu g/m^3$, respectively (EPA 2009e).

TABLE 17: RESULTS OF $PM_{2.5}$ AND PM_{10} MONITORING AT YELLOWSTONE NATIONAL PARK

Site ID	Location	Year	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)	
			Daily Value[1]	Annual Mean[2]	Daily Value[1]	Annual Mean[2]
300310012	Firehole, West Yellowstone[3]	1998	—	—	45	19
		1999	—	—	48	18
		2000	—	—	39	18
		2001	—	—	42	18
		2002	—	—	30	15
		2003	—	—	40	17
		2004	—	—	32	15
		2005	—	—	32	15
		2006	—	—	21	9
300310013	Yellowstone National Park, west entrance	2003	4.1	3.80	—	—
		2004	10.2	5.00	—	—
		2005	6.8	4.26	—	—
		2006	10.3	3.67	—	—
		2007	10.4	4.68	—	—
		2008	4.7	2.47	—	—

Source: EPA 2009e.

[1] Fourth highest 24-hour maximum.

[2] Fourth highest 24-hour maximum.

[3] Outside the park boundary, in the town of West Yellowstone.

— = Data not available.

Since 2003, ambient monitoring has been used in the winter to determine CO and $PM_{2.5}$ concentrations at two locations in the park, one at Old Faithful (Site ID 550391012) and another at the west entrance (Site ID 300310013), as part of the adaptive management program on the use of OSVs. CO and $PM_{2.5}$ are also monitored outside the park in the town of West Yellowstone, Montana, in cooperation with the park (Ray 2010a). Results for CO and $PM_{2.5}$ monitoring at the three stations are summarized in tables 18 and 19.

As part of the adaptive management program on the use of OSVs. CO and $PM_{2.5}$ are also monitored outside the park in the town of West Yellowstone, Montana, in cooperation with the park (Ray 2010a).

TABLE 18: RESULTS OF WINTER CARBON MONOXIDE (PPM) MONITORING AT YELLOWSTONE NATIONAL PARK MONITORING STATIONS

Old Faithful							
Winter Carbon Monoxide	2008/2009	2007/2008	2006/2007[1]	2005/2006	2004/2005	2003/2004	2002/2003
Max 1-hour	1.1	0.9	0.9	1.6	1.6	2.2	2.9
% of Standard	3%	2%	3%	4%	4%	6%	8%
Max 8-hour	0.4	0.4	0.4	0.5	0.8	0.9	1.2
% of Standard	4%	5%	4%	6%	7%	10%	13%
Average	0.1	0.19	0.27	0.18	0.12	0.26	0.24
90th percentile[2]	0.2	0.24	0.19	0.26	0.29	0.5	0.5
West Entrance							
Winter Carbon Monoxide	2008/2009	2007/2008	2006/2007	2005/2006	2004/2005	2003/2004	2002/2003
Max 1-hour	2.4	6.1	3.7	2.1	2.8	6.4	8.6
% of Standard	7%	17%	11%	6%	8%	18%	25%
Max 8-hour	0.6	1.6	0.8	0.9	1.0	1.3	3.3
% of Standard	6%	18%	9%	10%	11%	14%	37%
Average	0.2	0.23	0.19	0.23	0.24	0.26	0.57
90th percentile[2]	0.3	0.4	0.27	0.4	0.43	0.5	1.3
West Yellowstone, Montana[3]							
Winter Carbon Monoxide	2008/2009	2007/2008	2006/2007	2005/2006	2004/2005	2003/2004	2002/2003
Max 1-hour	7.9	6.7	5.0	—	—	—	—
% of Standard	23%	19%	14%	—	—	—	—
Max 8-hour	3.1	2.2	2.4	—	—	—	—
% of Standard	34%	25%	27%	—	—	—	—
Average	0.5	0.4	0.5	—	—	—	—
90th percentile[2]	0.9	0.7	0.9	—	—	—	—

Source: Ray 2010a.

[1] The visitor parking and the monitoring station moved due to construction at Old Faithful.

[2] The 90th percentile is not used by the NAAQS. It is a useful measure to track higher concentrations without the points being dominated by possible statistical outliers.

[3] Outside the park boundary, in the town of West Yellowstone.

—= Data not available from this source.

TABLE 19: RESULTS OF WINTER $PM_{2.5}$ (µG/M^3) MONITORING AT YELLOWSTONE NATIONAL PARK MONITORING STATIONS

Old Faithful							
Winter $PM_{2.5}$	2008/2009	2007/2008	2006/2007[2]	2005/2006	2004/2005	2003/2004	2002/2003
Max 1-hour	23	32	20	56	38	151	200
Max 24-hour	5.7	8.1	6.6	9	6	16	37
98th percentile[1]	5.2	5.8	6.4	9	9	9	21
% of Standard	15%	17%	18%	13%	14%	14%	33%
Average	3.1	3.2	3.3	3.5	4.0	4.9	6.9
West Entrance							
Winter $PM_{2.5}$	2008/2009	2007/2008	2006/2007	2005/2006	2004/2005	2003/2004	2002/2003
Max 1-hour	53	44	40	44	21	29	81
Max 24-hour	5.1	9.5	8.8	7	6	8	15
98th percentile[1]	4.8	7.8	8.7	6	6	7	17
% of Standard	14%	22%	25%	10%	9%	11%	26%
Average	1.5	2.6	2.1	1.9	2.9	4.0	8.2
West Yellowstone, Montana[3]							
Winter $PM_{2.5}$	2008/2009	2007/2008	2006/2007	2005/2006	2004/2005	2003/2004	2002/2003
Max 1-hour	145	167	119	—	—	—	—
Max 24-hour	27.5	24.7	32	—	—	—	—
98th percentile[1]	27	22	32	—	—	—	—
% of Standard	77%	63%	91%	—	—	—	—
Average	12.3	5.6	12.9	—	—	—	—

Source: Ray 2008, 2010a.

[1] Statistic that best relates to the NAAQS standard at the time of the measurement (65 µg/m^3). Based on daily 24-hour average.

[2] The visitor parking and the monitoring station moved due to construction at Old Faithful.

[3] Outside the park boundary, in the town of West Yellowstone.

—= Data not available from this source.

As described in chapter 1, after the BAT requirement and limitations on the number of OSVs permitted in the park were implemented, air quality improved quickly between the winters of 2002 and 2004 (Ray n.d.). CO concentrations have continued to decrease, with some fluctuation, since the 2002/2003 winter season. Measurements of the 8-hour CO levels improved from 1998/1999 to 2008/2009 by ten times. Maximum 1-hour concentrations of $PM_{2.5}$ have fallen at the Old Faithful monitoring location from 200 µg/m^3 during the 2002/2003 winter season to 23 µg/m^3 during the 2008/2009 winter season. Similarly, at the west entrance monitoring location, maximum 1-hour concentrations have fallen from 81 µg/m^3 during the 2002/2003 winter season to 53 µg/m^3 during the 2008/2009 winter season, with a low (between 2002 and 2009) of 21 µg/m^3 reported for the 2004/2005 winter season. Overall, from 2003 to 2009, air quality has stabilized at the monitoring stations in the park. These positive trends in air quality are primarily the result of requirements for BAT snowmobiles and a lower number of snowmobiles entering the park in recent years; requiring the use of only four-stroke engine snowmobiles has improved emissions despite the increasing number of snowcoaches now entering the park. Although these changes present an overall positive trend toward lower emissions by OSVs, other local sources, such as uncontrolled wood stoves in warming huts and some facilities in the park, still contribute to winter $PM_{2.5}$ concentrations. More recent air quality monitoring in the park (Ray 2008, 2010a) has revealed that although air quality at Yellowstone meets the national standards set by the EPA for CO and $PM_{2.5}$ to protect human health, CO concentrations up to 200 ppb in the park are still above the background CO concentrations for Yellowstone, which are estimated at less than 100 ppb. Results of winter 2008/2009 air monitoring for Yellowstone reveal diminishing daily average concentrations of $PM_{2.5}$ in the park, with concentrations in the town of West Yellowstone remaining constant or increasing slightly over previous years. Hourly and 8-hour average CO concentrations have recently decreased at the west entrance while remaining relatively constant at Old Faithful (Ray 2010a).

On February 9, 2010, the EPA announced a revised NO_2 standard of 100 ppb as a one-hour average (75 FR 6474).

On February 9, 2010, the EPA announced a revised NO_2 standard of 100 ppb as a one-hour average (75 FR 6474). This standard was promulgated as a result of scientific evidence linking short-term NO_2 exposures with increases in asthma and other respiratory illness, and the new standard is a significant change from the previous 53 ppb annual average. Because hourly NO_2 data had not previously been collected at Yellowstone, a joint plan with the Montana Department of Environmental Quality was created to do exploratory winter NO_x monitoring at the west entrance. Monitoring equipment was installed at the west entrance just before the opening of the winter season in December 2009.

Two different NO_2 analyzers were used during the 2009/2010 study; the first analyzer barely passed audit and calibration checks; the second analyzer was new and performed well. Although NO_2 concentrations of just under 50% of the NAAQS (100 ppb 1-hour average) were observed with the first analyzer, the more reliable values are from the replacement analyzer with NO_2 concentrations up to 26% of the health standard (Ray 2010b). In addition, early winter NO_2 monitoring results for winter 2010/2011 show a daily maximum hourly concentration of 31 ppb, less than the 45 ppb maximum recorded in 2009/2010. The available monitoring data supports the conclusion that the park is in compliance with the NAAQS for NO_2. There is an insufficient record of NO_2 monitoring data to draw firm conclusions about NO_2 concentration trends in the park at this time. NPS will continue NO_2 monitoring to better understand any trends in concentrations and the relationship between NO_2 concentrations and specific OSV types.

SOUNDSCAPES

INTRODUCTION

The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds are intrinsic elements of the environment and part of "the scenery and the natural and historic objects and the wild life" protected by the NPS Organic Act.

According to the NPS *Management Policies 2006* and Director's Order 47: Sound Preservation and Noise Management, an important component of the NPS mission is the preservation of natural soundscapes associated with national park units (NPS 2006a). Natural soundscapes exist in the absence of human-caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds are intrinsic elements of the environment and part of "the scenery and the natural and historic objects and the wild life" protected by the NPS Organic Act. They are vital to the visitor experience of many parks and provide valuable indicators of the health of various ecosystems. Inappropriate sounds are of concern because they can impede ecological function and diminish the ability of the NPS to accomplish its resource protection mission.

Natural sounds are necessary for ecological functioning and occur within and beyond the range of sounds that humans can perceive. Many mammals, insects, and birds decipher sounds to find desirable habitat and mates, avoid predators and protect young, establish territories, and to meet other survival needs.

Natural soundscapes are also important to park visitors. A majority of park visitors value and enjoy natural sounds, solitude, and quiet (Mace et al. 2004). The opportunity to experience natural sounds is perceived by winter visitors to be important to both the value of Yellowstone and the visitors' experiences (Freimund et al. 2009). For many visitors, the ability to hear clearly the delicate and quieter intermittent sounds of nature, the ability to experience interludes of extreme quiet for their own sake, and the opportunity to do so for extended periods of time are important reasons for visiting national parks.

OVERVIEW OF YELLOWSTONE SOUNDSCAPES

Currently, winter soundscapes in Yellowstone consist of both natural and non-natural sounds. Bird and animal calls, running water, wind, and thermal activity (e.g., geysers and hot springs) contribute natural sounds to Yellowstone. Non-natural sounds include those produced by snowmobiles, snowcoaches, snow groomers, aircraft, human voices, wheeled vehicles, and building operations (Burson 2009). Yellowstone's soundscapes vary greatly with location, time of day, and time of year. The audibility of OSVs in the park is influenced by environmental conditions including type of terrain, vegetation cover, wind speed and direction, presence of natural sounds (wind, bird call, and geyser activity), snow cover, and other atmospheric conditions. In general, low frequency sounds travel farther from the source at lower temperatures. Wind sounds often mask low-level motorized sound, limiting the audibility of motorized sounds at a site; the frequency of the sound and any movement of the other sound source also contribute to audibility.

Yellowstone's winter soundscapes, as experienced by most visitors, include sound from OSV use (Burson 2009), because most visitors either use OSVs to tour the park or stay within two miles of motorized routes if engaging in non-motorized uses. Overall, audibility of OSVs has been reduced since the 2002/2003 winter season by limiting the number of OSVs allowed in the park daily, reducing the number of groups, requiring visitors to use BAT snowmobiles, limiting motorized access to few park roads and travel corridors, and enforcing a low speed limit. Results of soundscape monitoring conducted from 2003 to 2010 show that although certain areas of the park have some of the lowest sound levels ever recorded (Burson 2004–2010a), many travel corridors and developed areas, particularly those near motorized routes or with heavy use, experience higher sound levels.

Yellowstone's winter soundscapes, because experienced by most visitors, include sound from OSV use (Burson 2009), as most visitors either use OSVs to tour the park or stay within two miles of motorized routes if engaging in non-motorized uses.

SOUNDSCAPES TERMINOLOGY

This section introduces the key terms used to evaluate soundscapes, and discusses the factors that influence human perception of sounds.

Percent Time Audible

Percent time audible is a metric used to describe the amount of time during the analysis period (e.g., hour, day, or season) that OSVs are audible to a human with normal hearing. Audibility of OSVs is determined, in part, by the natural ambient sound levels. Lower natural ambient sound levels result in higher OSV percent time audible. The converse is also true: higher natural ambient sound levels result in lower OSV percent time audible. The percent time audible indicator does not provide information on how loud or quiet OSV sounds are, only whether they are audible or not. Therefore, additional indicators of sound levels are also important to consider in conjunction with percent time audible.

Sound Levels

The magnitude of noise is described by its sound pressure. Because the range of sound pressure varies greatly, the logarithmic scale decibel (dB) is used to relate sound pressure. Sound pressures described in decibels are often defined in terms of frequency-weighted scales. A sound level measurement is usually expressed as an A-weighted average energy value over a specified time interval. A-weighting provides a method of summing sound energy across the audible spectrum in a way that approximates human judgments of loudness. The standard way to express these measurements is LA_{eq}, T, where T refers to the time interval for the measurement, “A” refers to A-weighting, and “L_{eq}” refers to the energy averaging. This notation is a bit cumbersome, so this document will follow a widely used shorthand and refer to “dBA.” Unless otherwise noted, the time interval for the energy averaging (“T”) is 1 second in all NPS measurements and modeling. Several examples of sound pressure levels in dBA scale are listed in table 20, including typical sounds found in Yellowstone.

Because sound is described in a logarithmic scale (i.e., dBA), sound levels cannot be added by ordinary arithmetic. An increase of 3 dB represents a doubling of sound energy, so two helicopters flying side-by-side would be 3 dB louder than one. A 6-dB increase represents a quadrupling of energy and this increase generally doubles the distance at which the sound can be heard. Decibels are often related to perceived loudness, and in some frequency bands a 10-dB increase is said to double the loudness of the sound, even though this would correspond to multiplying the number of sound sources by 10. Urban noise studies have shown that community annoyance tends to double with every 5 dB increase in noise (ANSI Standard 12.9-2005/Part 4, table F.1).

Sound Level Metrics

Metrics used to describe sound levels include L_{eq}, L_{min}, L_{max}, L_{50}, and L_{90}. L_{eq} is the constant sound level that conveys the same energy as the variable sound levels during the analysis period. For example, the 8-hour L_{eq} levels discussed in this section take into account the magnitude and duration of OSV sound over an 8:00 a.m. to 4:00 p.m. analysis period (including times when OSV sounds are not audible).

The L_{min} is the lowest sound level measured in the analysis period, and the L_{max} is the maximum. The L_{50} value represents the sound level exceeded 50% of the measurement period. L_{50} is the same as the median; the middle value where half the sound levels are above and half below. The L_{90} value represents the sound level exceeded 90% of the time during the measurement period. L_{90} is a useful measure of the natural sounds because in park situations, away from developed areas and busy travel corridors, the lowest 10% of sound levels are less likely to be affected by non-natural sounds.

Sound levels depend on the distance from the sound source, the presence of natural sounds, and non-sound source variables such as atmospheric conditions, wind speed and direction, topography, snow cover, and vegetation cover.

TABLE 20: DECIBEL LEVELS OF COMMON SOUND SOURCES

Sound	Noise Level (dB)	Effect
Shotgun firing, jet takeoff (at 100-200 feet)	130	Painful
Turbo-prop at 200 feet, rock concert	110-140	Threshold of pain begins around 125 dB
Thunderclap (near)	120	Threshold of sensation begins
Stereo (over 100 watts)	110-125	Regular exposure to sound over 100 dB of more than one minute risks permanent hearing loss
Symphony orchestra, chainsaw, jackhammer	110	
Jet flyover (1,000 feet)	103	
Electric furnace, garbage truck, cement mixer	100	No more than 15 minutes of unprotected exposure recommended for sounds between 90-100 dB
Subway, motorcycle (at 25 feet)	88	Very annoying
Lawnmower/nearby thunder	85-90	85 dB is the level at which hearing damage (8 hrs) begins
Recreational vehicles	70-90	
Diesel truck (40 mph at 50 feet)	84	80 dB or higher is annoying, interferes with conversation, constant exposure may cause damage
Snowcoach at 50 feet, average city traffic	77-80	
Dishwasher, washing machine	75-78	70 dB or higher is intrusive, interferes with telephone conversation
Two-stroke snowmobile (30 mph at 50 feet), vacuum cleaner	70	
Four-stroke snowmobile (30 mph at 50 feet), automobile (45 mph at 100 feet)	60	Comfortable hearing levels are less than 60 dB.
Croaking raven (100 feet), conversation	50-65	
Quiet Office	50-60	
Refrigerator humming, Snake River (at 100 feet)	40	Quiet
Summer backcountry, Snake River (at 300 feet)	30	
Natural ambient sound levels in Yellowstone	0-25	
Rustling leaves, winter backcountry	20	Very quiet
Normal breathing	10	Barely audible
Lowest ambient sound levels in Yellowstone winter backcountry	0	Approximate threshold of human hearing at 1 kHz

Table adapted from the National Institute on Deafness and Other Communicative Disorders at http://www.nidcd.nih.gov/health/education/teachers/common_sounds.asp.

Human Perception of Sounds

Percent time audible and sound level metrics are important indicators of the condition of natural soundscapes. Percent time audible and sound level metrics are the appropriate focus of NPS monitoring and management of natural soundscapes because they are measurable and objective. However, in interpreting these metrics it is important to also consider that human perception to sounds is complex and setting-dependent. Research conducted on sound perception demonstrates that a person's evaluation of a sound depends on the information contained in the sound and the context in which it is received (Carles et al. 1999; Abe et al. 2006). Specifically, perceived sound levels and evaluation of the sound vary with place, sound frequency, expectation of hearing the sound, individual experience of the listener, perceived “appropriateness” of the sound to the setting, movement of the sound relative to the listener, and visual cues (Blauert 1986; Kuwano et al. 1989; Carles et al. 1999; Ozawa et al. 2003; Schulte-Fortkamp et al. 2007). For additional detailed information regarding the factors influencing human perceptions of sounds, refer to the Scientific Assessment of Yellowstone National Park Winter Use, Section 5.1.3, “Factors that Determine Visitors’ Interpretation of Sound.”

SOUNDSCAPES MONITORING

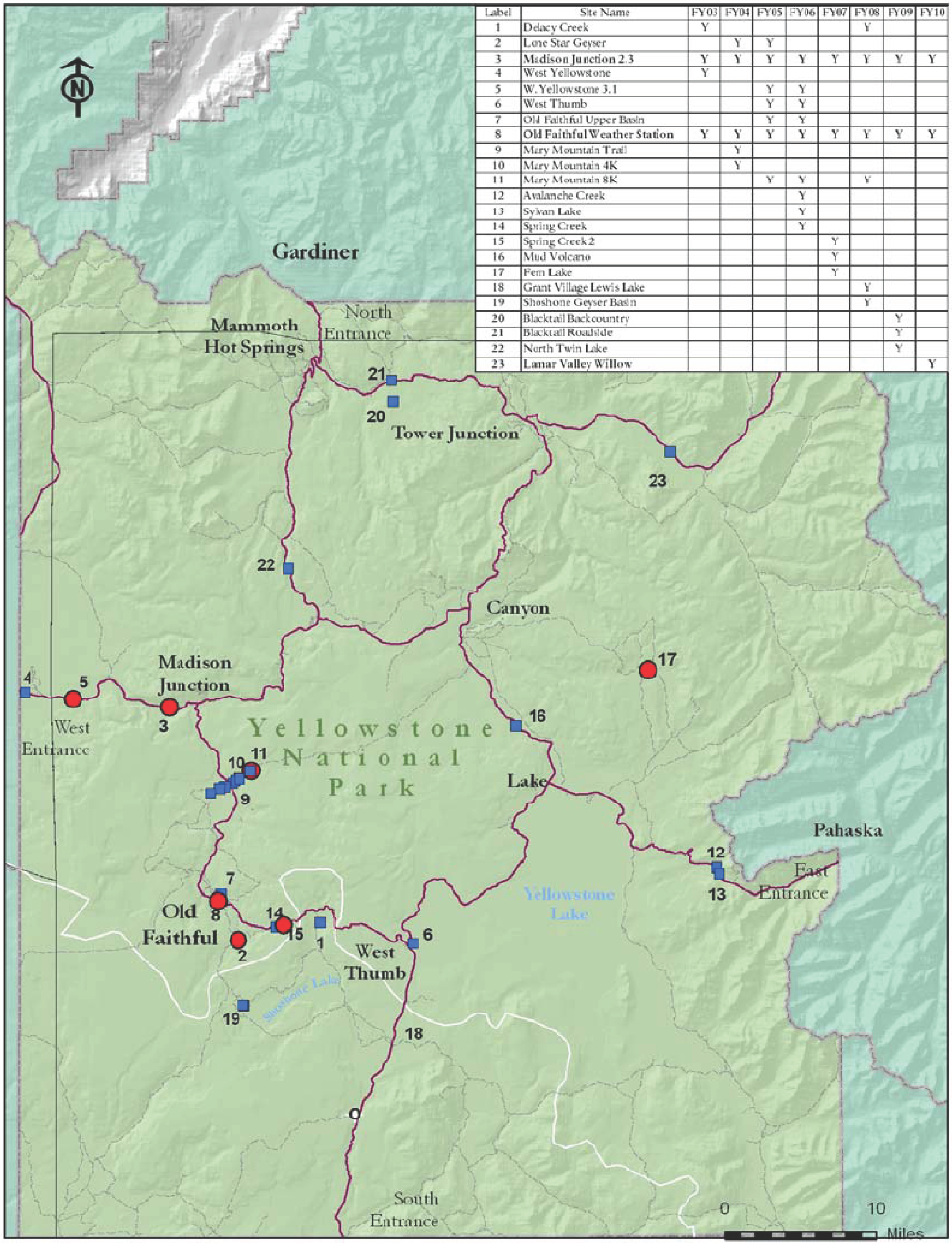
NPS has conducted winter soundscapes monitoring in Yellowstone since the 2003/2004 season. The most recent soundscapes monitoring data at the time this draft Winter Use Plan and Environmental Impact Statement (plan/EIS) was prepared was for the 2009/2010 winter season (Burson 2004–2010a). A total of 21 locations in the park have been monitored during at least one winter season. Two locations have been monitored every season since monitoring began: Madison Junction 2.3 (100 feet off the west entrance road, 2.3 miles west of Madison Junction) and the Old Faithful Weather Station. Figure 11 shows the locations of the monitoring sites and indicates which sites were monitored during each winter season.

Automated acoustic monitors were used to collect 1-second L_{eq} sound levels and digital recordings. Digital recordings of the soundscape were either sampled for 10 seconds every 4 minutes, or were collected continuously, 24 hours per day. For sites and times that digital recordings were not collected continuously, additional 20 second recordings were made during sound events that exceeded 70 dBA for 1 second or 60 dBA for 10 seconds. The recordings were analyzed to determine the source of each audible sound (e.g., snowmobile, animal, aircraft, wind, thermal activity), as well as the percentage of time each sound source was audible. Detailed technical information on the soundscapes monitoring and data analysis can be found in Burson 2004–2010a.

The acoustic monitors were not capable of distinguishing between the various OSV user groups in the park (e.g., visitors, administrative). To determine the type and proportion of OSV use in the park, a separate observational study was conducted during the past six winters, from 2005 to 2010. Data on the time audible, and type of usage for each OSV was collected by observers at locations in developed areas and travel corridors (Burson 2010a).

Percent Time Audible

Percent time audible metrics can vary considerably depending on the analysis period selected (e.g., hour, day). The 8:00 a.m. to 4:00 p.m. percent time audible provides a useful summary metric that reflects the time that most visitors are in the park. Table 21 summarizes the percent of the time between 8:00 a.m. to 4:00 p.m. that OSVs were audible at the Old Faithful Weather Station and Madison Junction 2.3. Table 22 summarizes the percent time audible information for other locations throughout the park that have been monitored only 1 or 2 years.



Label	Site Name	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10
1	Delacy Creek	Y					Y		
2	Lone Star Geyser		Y	Y					
3	Madison Junction 2.3	Y	Y	Y	Y	Y	Y	Y	Y
4	West Yellowstone	Y							
5	W. Yellowstone 3.1			Y	Y				
6	West Thumb			Y	Y				
7	Old Faithful Upper Basin			Y	Y				
8	Old Faithful Weather Station	Y	Y	Y	Y	Y	Y	Y	Y
9	Mary Mountain Trail		Y						
10	Mary Mountain 4K		Y						
11	Mary Mountain 8K			Y	Y		Y		
12	Avalanche Creek				Y				
13	Sylvan Lake				Y				
14	Spring Creek				Y				
15	Spring Creek 2					Y			
16	Mud Volcano					Y			
17	Fern Lake					Y			
18	Grant Village Lewis Lake						Y		
19	Shoshone Geyser Basin						Y		
20	Blacktail Backcountry							Y	
21	Blacktail Roadside							Y	
22	North Twin Lake							Y	
23	Lamar Valley Willow								Y

Note: Red circles indicate sites monitored in multiple seasons. Blue squares indicate sites monitored in winter only.

FIGURE 11: LOCATION OF SOUND MONITORING LOCATIONS 2003–2010

TABLE 21: DAILY PERCENT TIME AUDIBLE (8:00 A.M.-4:00 P.M.) OF OVERSNOW VEHICLE SOUNDS AT OLD FAITHFUL AND MADISON JUNCTION 2.3

Management Zone	Site Name	Map ID	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010
Developed	Old Faithful Weather Station	8	61%	69%	67%	68%	68%	55%	55%
Travel Corridor	Madison Junction 2.3	3	25%**	61%**	55%	59%	53%	47%	54%

**Indicates monitoring for only 1 or 2 days (may not represent typical or average acoustic conditions).

TABLE 22: DAILY PERCENT TIME AUDIBLE (8:00 A.M.-4:00 P.M.) OF OVERSNOW VEHICLE SOUNDS AT OTHER LOCATIONS

Management Zone (described in chapter 2)	Site Name	Map ID	Year(s) Monitored	Percent Time Audible
Developed	West Thumb Geyser Basin	6	2004/2005	47%*
			2005/2006	62%*
Travel Corridor	West Yellowstone 3.1	5	2004/2005	55%
	Spring Creek	14	2005/2006	34%*
	Spring Creek 2	15	2006/2007	44%
	Grant Village Lewis Lake	18	2007/2008	37%
	Mud Volcano	16	2006/2007	26%
	North Twin Lake	22	2008/2009	24%*
Transition	Mary Mountain Trail	9	2003/2004	32%
	Old Faithful Upper Basin	7	2004/2005	29%
			2005/2006	35%
	Mary Mountain 4k	10	2003/2004	13%**
	Delacy Creek Trail	1	2007/2008	20%*
	Lone Star Geyser Basin	2	2003/2004	3%
			2004/2005	4%
Backcountry	Mary Mountain 8k	11	2004/2005	26%
			2007/2008	26%*
	Shoshone Geyser Basin	19	2007/2008	18%*
	Fern Lake Backcountry	17	2006/2007	0%

*Indicates monitoring for 7 days or less (may not represent typical or average acoustic conditions).
**Indicates monitoring for only 1 or 2 days (may not represent typical or average acoustic conditions).

The monitoring results show that the highest percent time audible levels are in the most developed and heavily traveled portions of the park—Old Faithful and Madison Junction 2.3. Daily percent time audible decreases to 0% to 30% in the transition and backcountry areas farther from road corridors. Based on all the available monitoring data, the average percent time audible was 59% for developed areas, 39% for travel corridors, 20% for transition zone, and 15% for backcountry areas (Burson 2010a).

There is considerable variation in percent time audible between sites, even within the same management zone, due to factors such as the number and type of OSVs on different road segments and topography. Percent time audible does not always correlate with distance from roadways. For example, the percent time audible at the Lone Star Geyser Basin site was 3% to 4%, compared to 18% at the Shoshone Geyser Basin site. The Shoshone Geyser Basin site is four miles farther from a road than the Lone Star Geyser Basin site. Topography and frequent, prolonged geyser activity were likely the reasons that OSVs were less audible at Lone Star Geyser than at Shoshone Geyser Basin (Burson 2010a).

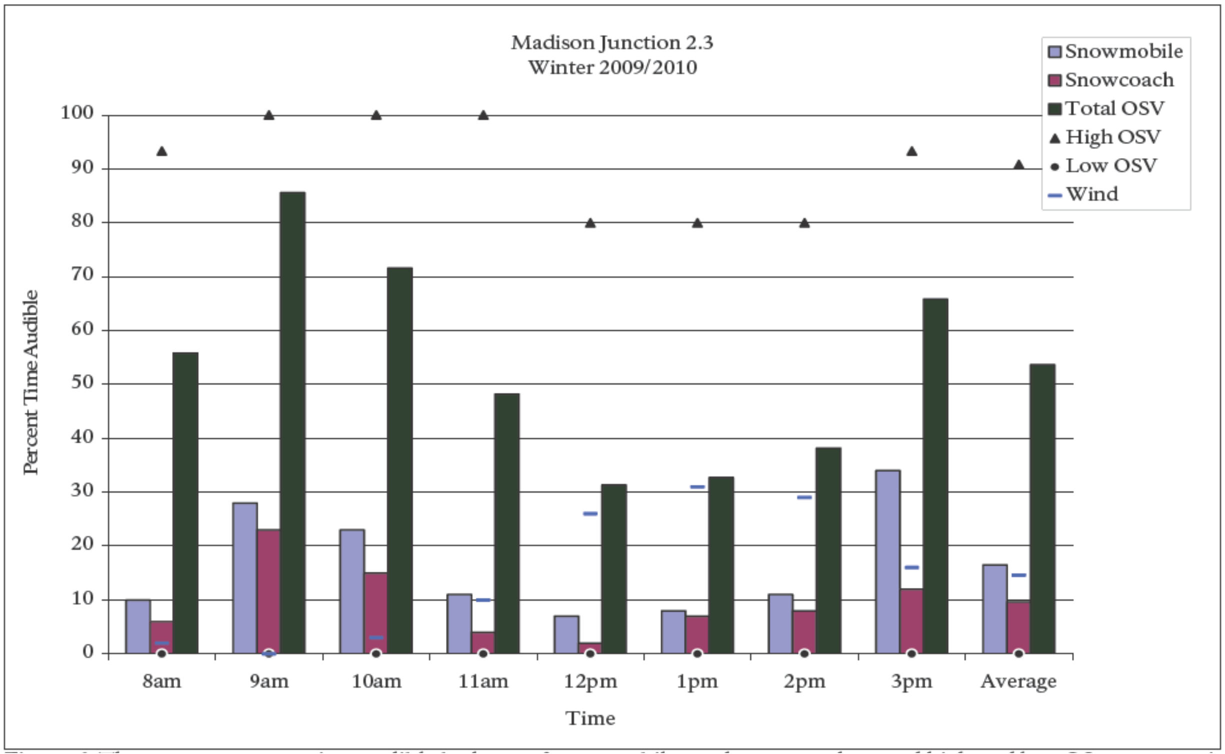
Prior to the implementation of snowmobile guiding and BAT requirements during winter 2002/2003, the average percent time OSVs were audible at the Old Faithful Weather Station was close to 93%. The percent time audible was reduced to an average of 61% during winter 2003/2004.

One trend that emerges in the review of the continuous record of data at the Old Faithful weather station is the decrease in percent time audible in the 2008/2009 season compared to past years. The average percent time audible at the Old Faithful weather station was 67% to 69% from winter 2004 to winter 2008. In 2008/2009 and 2009/2010 winter seasons, the percent time audible at the Old Faithful weather station decreased to 55% as both snowmobile and snowcoach entries dropped.

The Madison Junction 2.3 site experienced a smaller decrease in percent time audible in 2008/2009 than the Old Faithful weather station. Unlike the Old Faithful weather station site, the Madison Junction 2.3 site experienced an increase in percent time audible from 47% in 2008/2009 to 54% in 2009/2010. The increase in percent time audible in 2009/2010 is at least partially attributable to a decrease in the length of time wind was audible (wind can mask OSV sounds). Wind was audible at Madison Junction 2.3 only 15% of the time in 2009/2010, compared to 27% of the time in 2008/2009 (Burson 2010a).

Figure 12 provides an example of the variation in percent time audible by hour at Madison Junction 2.3 in the 2009/2010 winter season. Percent time audible exceeded 80% during the morning when many OSVs are entering the park, but dropped to less than 35% time audible midday. A peak number of OSVs leaving the park occurred in the afternoon; resulting in a percent time audible of over 60% between 3:00 p.m. and 4:00 p.m. OSVs were audible for an average of 54% of the time during the winter use season at Madison Junction 2.3.

As shown in figure 11, three sites have been monitored on the plowed roads in the northern part of the park (Blacktail Backcountry, Blacktail Roadside, and Lamar Valley Willow). The percent time audible at these sites is not influenced by OSVs—only wheeled vehicles are audible. OSVs are not audible due to the distance between these monitoring sites and the nearest OSV routes (see figure 11). The Lamar Valley Willow monitor was 142 feet from the road between Tower Junction and the northeast entrance. The percent time audible for wheeled vehicles in the 2009/2010 season was 66% between 8:00 a.m. and 4:00 p.m. Wheeled vehicles were audible an average of 12% of the time in the 2008/2009 winter season at the Blacktail Backcountry site 1.5 miles from the plowed road between Mammoth and Tower Junction. At 100 feet from the road, the Blacktail Roadside had an average percent time audible of 34% in 2008/2009. At both the Blacktail Backcountry and Blacktail Roadside sites wind was audible on the majority of days and likely masked wheeled vehicle audibility.



Note: Graphic shows the average percent time audible by hour of snowmobiles and snowcoaches (between 8:00 a.m. and 4:00 p.m.) and high and low OSV percent time audible at 2.3 miles (3.7 kilometers) west of Madison Junction on the west entrance road, Yellowstone National Park, December 15, 2009–March 15, 2010.

FIGURE 12: AVERAGE OSV PERCENT TIME AUDIBLE BY HOUR

Sound Levels

Table 23 summarizes sound level metrics for the 2008/2009 and 2009/2010 winter seasons at the Old Faithful Weather Station and Madison Junction 2.3. Maximum sound levels at these relatively heavily traveled locations were close to or exceeded 75 dBA between 8:00 a.m. and 4:00 p.m. Snowcoaches were noted to be the main source of the loudest events recorded during the monitoring studies.

TABLE 23: SOUND LEVEL METRICS, 8:00 A.M. TO 4:00 P.M.

	Old Faithful Weather Station (Developed)		Madison Junction 2.3 (Travel Corridor)	
	2008/2009	2009/2010	2008/2009	2009/2010
L_{min}	22.0	23.7	17.8	15.3
L_{90}*	31.2	30.0	26.7	22.0
L_{50}*	36.7	35.2	30.6	28.2
L_{eq}*	42.1	41.9	43.7	42.2
L_{max}	77.7	74.5	78.2	79.5

*Median from hourly calculations

The 8-hour L_{eq} sound level at Old Faithful Weather Station and Madison Junction 2.3 was slightly higher than 40 dBA.

The minimum sound levels at Old Faithful Weather Station and Madison Junction 2.3 were similar to the natural ambient sound level in the park (15 to 20 dBA). The L_{90} and L_{min} at Old Faithful Weather Station were influenced by sounds created by the exhaust and heating fans at the Snow Lodge and Ranger Station. At Madison Junction 2.3, the L_{90} and L_{min} are influenced by riffles from the nearby Madison River. The minimum sound levels are constrained by limitations of the acoustic instruments in measuring extremely quiet sounds.

Observational Study Results

The 2005–2010 observational study summarized in Burson (2010a) found that in developed areas 78% of snowmobile traffic consisted of guided visitor snowmobiles and 18% consisted of administrative snowmobiles. The percentage of guided visitor snowmobiles was higher along travel corridors (92%) compared to the developed areas because administrative snowmobile use is more frequent in developed areas. A great majority of the loud noise events were found to be caused by snowcoaches, which are not yet BAT equipped (Burson 2009). The average visitor snowmobile group size was 7.25, whereas the average administrative snowmobile group size was just over one. Snowcoaches transporting visitors accounted for 85% of total snowcoach traffic in developed areas and 94% in travel corridors.

Visitor snowmobiles tend to travel in groups, whereas administrative snowmobile groups are typically single vehicles, and do not necessarily travel with the usual flow of visitor traffic in and out of the park. This is important in understanding the relationship between the percent time audible and OSV numbers.

Overall, motorized sounds were audible 56% of the time during the observational study. Snowmobiles accounted for 56% of the duration of motorized sounds, compared to 28% for snowcoaches and 7% for airplanes and helicopters. A total of 7,691 snowmobiles were tallied over the course of the study, compared to 1,033 snowcoaches. The time audible percentages were not in proportion to these numbers because the grouping of snowmobiles concentrates the usage time and, therefore, the time they are audible. As noted above, visitor snowmobiles tend to travel in groups, whereas administrative snowmobile groups are typically single vehicles and do not necessarily travel with the usual flow of visitor traffic in and out of the park. This is important in understanding the relationship between the percent time audible and OSV numbers. In developed areas, administrative snowmobiles are 63% of the snowmobile groups. Along road corridors, administrative groups are 33% of the snowmobilers.

VISITOR USE AND EXPERIENCE

VISITOR ACCESS AND CIRCULATION

Regional Access

Yellowstone has five entrances—one each on the north, east, west, and south boundaries and one in the northeast. Year-round wheeled vehicle road access into the park is provided from Gardiner, Montana, across the northern area of the park to Cooke City, Montana. At Cooke City, Highway 212 is closed to the east from October to May. All other park entrances are closed from early November to mid-December, re-open for the winter season, and close again in early to mid-March to allow for spring plowing.

Park Roadways, Trails, and Winter Facilities

About half of the park's winter visitors enter the park through the north entrance. The west entrance is the next busiest, with about 33% of winter visitors.

Certain roads within the park are maintained for numerous reasons, including tourism and sightseeing, accessing trailheads, and park management. During the winter, most park roads are closed to wheeled vehicular traffic with the exception of Highway 191, which provides access between West Yellowstone and Bozeman, Montana, and the park road from Gardiner to Mammoth to the northeast entrance (Cooke City). The plowing of these roads totals approximately 78 miles, 20 of which are plowed by the state of Montana (NPS 2007c). These roads provide the only wheeled vehicle access through the park and are used by many visitors to view wildlife or access trailheads for cross-country skiing, snowshoeing, and/or hiking. In recent winters, the north entrance has been the busiest in the winter. About half of the park's winter visitors enter the park through the north entrance. The west entrance is the next busiest, with about 33% of winter visitors. The south entrance accounts for 16%, with the east entrance admitting 0.5%. During the winter, the northeast entrance is not staffed.

OSV travel is allowed on most main line interior park road segments (see figure 2), with the exception of Dunraven Pass between Tower and Washburn Hot Springs overlook, which is closed due to avalanche danger. Where OSV travel is allowed, the roads are groomed. Grooming begins when there is adequate snow cover, using a tracked vehicle equipped with a blade on the front and a packer wheel and drag at the rear. The road segments from the west entrance to Old Faithful are usually groomed nightly or every other night. Most other sections are usually groomed every two to three nights. The NPS grooms 193 miles of OSV routes in the park.

About 35 miles of road are groomed for non-motorized uses in Yellowstone. These roads include the Blacktail Plateau Drive, Bunsen Peak Road, Upper Terrace Drive, North Canyon Rim Trail, Lone Star Geyser, and other trails in the Old Faithful area. The portion of the Dunraven Pass Road from Tower Junction past Tower Fall to the top of the Chittenden Road is groomed for skiing. In addition to the machine groomed roads, parallel tracks are set on the sides of some of Yellowstone's snow roads, typically including west entrance to Madison (14 miles one way); Madison to Old Faithful (16 miles one way); and Madison to Norris (12 miles one way). These are established each time the road is groomed (every two or three days) and may be obliterated by snowcoach and snowmobile travel.

Staging areas, or points of access, for oversnow routes into the park are an important logistical component of the winter visitor experience. They typically include a parking area with appropriate signage and may have restrooms and other facilities. The staging areas for snowmobile and snowcoach trips into the park are near Mammoth Hot Springs in the north, at Pahaska Teepee in the Shoshone National Forest three miles from the east entrance, at Flagg Ranch two miles from the south entrance, and in West Yellowstone adjacent to the west entrance.

Oversnow Modes of Transportation

Snowcoaches have been used in Yellowstone since the mid-1950s, well before snowmobiles first arrived on the scene in the early 1960s. Businesses in surrounding communities have run touring enterprises based exclusively on providing snowcoach tours (whereas some offer both snowcoach and snowmobile tours). The earliest snowcoaches were Bombardiers, purpose built machines designed for oversnow travel. Many continue in operation today. In the 1970s, conversion of wheeled vehicles to OSVs began. These are 12- to 30-passenger vans to mid-size buses whose wheels have been replaced with track and/or ski assemblages. Some conversion snowcoaches are accessible to the handicapped. Some coaches now have double-paned or vented windows that resist fogging in the cold winter air. Snowcoach operation and speed depend on a variety of conditions, especially weather and snow conditions. Under most winter conditions, however, they can maintain speeds of 15 to 25 mph. Snowcoaches get 2 to 4 miles per gallon, depending on snow conditions.

In 2003, the NPS signed contracts with 14 businesses authorizing them to operate a specified number of snowcoaches for tours of the park for 10 years. A total of 78 snowcoaches are authorized to operate every day in the park. The snowcoaches carry 12 to 30 passengers per day, with a visitor capacity of approximately 936 visitors per day.

Snowmobiles were first used in Yellowstone in 1963, and thousands of visitors had entered the park using snowmobiles by the 1980s. Businesses in surrounding communities have run touring enterprises based exclusively on providing snowmobile tours and rentals (whereas others offer both snowcoach and snowmobile tours). In the early 2000s, manufacturers introduced four-stroke machines, which substantially reduced emissions and somewhat reduced (and certainly changed the quality of) snowmobile sound.

Since the winter of 2004/2005, all snowmobiles have been required to use commercial guides in the park and to use BAT machines. From 2004 to 2009, snowmobile use levels were capped at a maximum level of 720 per day. For the 2009/2010 and 2010/2011 winter season, the limit was 318 snowmobiles per day. Guided snowmobile service is available from a total of 22 different companies at the various park entrances.

Since the winter of 2004/2005, all snowmobiles have been required to use commercial guides in the park and to use BAT machines.

Visitation and OSV Transportation Modes

Total visitation to the park during the 2009/2010 winter season decreased approximately 25.6 percent from the 1999/2000 winter season (NPS 2010h). The change in visitation numbers—specifically among OSV users—is, in part, attributable to the daily limit on numbers, the commercial guide requirement, and the BAT requirement. Table 24 provides the visitor use numbers in Yellowstone by transportation mode for the winter seasons 1999/2000 through 2009/2010. The winter season runs from mid-December through mid-March; visitor counts include the entire months of December and March.

An increase in those using cars, recreational vehicles, and buses to access and enjoy park resources during the winter months of December through March has occurred. Only one road provides access to the park for these vehicle types; therefore, the totals for these modes of transportation presented in table 24 include numbers for the north entrance only.

The numbers presented below for snowmobiles and snowcoaches include all entering the park, not just those via the north entrance. Snowcoach travel increased by 74.3% between the 1999/2000 and 2009/2010 winter seasons, whereas snowmobile travel decreased by 71.0% during the same period (see table 24) (NPS 2010h).

TABLE 24: NUMBER OF VISITORS BY TRANSPORTATION MODE, WINTER SEASONS 1999/2000 TO 2009/2010

Winter Season	Recreation	Automobile	Recreation Vehicle	Bus	Snowmobile	Snowcoach	Total*
1999/2000	130,563	45,162	139	747	76,571	11,699	333,774
2000/2001	139,122	43,036	138	3,071	84,473	11,683	347,939
2001/2002	144,490	47,750	215	417	87,206	11,832	351,844
2002/2003	112,741	41,666	278	796	60,406	12,154	291,647
2003/2004	86,107	42,767	181	1,141	30,210	14,823	252,508
2004/2005	83,235	42,639	138	1,153	24,049	17,218	292,612
2005/2006	88,718	44,136	92	1,288	28,833	19,856	284,753
2006/2007	95,675	45,519	144	1,658	31,805	20,350	297,809
2007/2008	99,975	48,404	104	1,667	31,420	22,344	294,357
2008/2009	86,784	45,088	221	1,945	23,417	18,963	244,598
2009/2010	93,838	52,662	643	1,121	22,228	20,388	248,232
Average	105,568	45,348	208	1,364	45,511	16,483	294,552

Source: NPS Park Statistics. 2010. http://www.nature.nps.gov/stats/viewReport.cfm (NPS 2010h).

*The total number of visitors to Yellowstone does not equal the sum of the different modes used once visitors are inside the park. All numbers are best estimate.

Snowmobiling is a primary activity in the park during the winter season (Freimund et al. 2009). Other activities enjoyed by visitors include cross-country skiing (16%), snowcoaches (13%), snowshoeing and wildlife viewing (8%), photography (2%), and unknown (12%).

Cross-country Skiing

Table 25 provides the average daily number of snowmobiles and snowcoaches in the park during specific winter seasons. Because the number of snowmobiles permitted in the park on a given day changed over the most recent seasons, the daily limit column shows the maximum number of OSVs permitted in the park on a given day during the winter season. During the first three winter seasons (2006/2007 through 2008/2009), the maximum number of snowmobiles permitted in the park each day was 720. The daily average ranged from 205 to 299 snowmobiles (NPS 2010h).

TABLE 25: AVERAGE DAILY OSVS, WINTER SEASONS 2006/2007 TO 2009/2010

Winter Season	Snowmobile			Snowcoach		
	Daily Average	Peak	Daily Limit	Daily Average	Peak	Daily Limit
2006/2007	299	542	720	34	58	78
2007/2008	294	557	720	35	60	78
2008/2009	205	426	720 (540)*	29	54	78
2009/2010	187	293	318	32	59	78

Source: Recent Yellowstone Oversnow Winter Use Patterns, Summary of Air Quality Workshop, NPS 2010o.

*Although the daily limit was 720, guides and outfitters had planned for a 540 snowmobile limit, based on a winter plan that was overturned in late 2008.

Snowmobiles

Although the number of snowmobiles permitted in the park changed between the 2008/2009 and 2009/2010 winter seasons, the number of snowcoaches permitted remained unchanged. Over the past four winter seasons, the average daily number of snowcoaches in the park ranged from 29 to 35 vehicles. This translates into a utilization rate of between 37.2% and 44.9%. Snowcoach use on peak days ranged from 54 to 60 vehicles, for a utilization rate of between 69.2% and 76.9%. Snowcoach utilization rates are also affected by the multiple trips some coaches make in a day. For example, a Xanterra coach originating at Old Faithful may do a ski-drop in the morning, a mid-day trip to the west entrance to pick up visitors, and an early evening moonlight tour (NPS 2010o).

Snowcoach

Average ridership per mode (snowmobile or snowcoach) has been calculated and is available for the 2006/2007 through 2008/2009 winter seasons. Information for the 2009/2010 winter use season was unavailable at the time of publication. The average number of groups per day ranges from 31 to 42, with an average of between 6.6 and 6.9 vehicles per group. The number of people per snowmobile averaged 1.3.

In the 2007/2008 winter season, the average daily number of snowmobiles was five vehicles less than the previous season. Additionally, the number of commercially guided snowmobile groups was 14.3% less than the previous year. The average number of people per group was 9.3, as compared to 9.1. The average number of snowcoaches, as well as people per coach, was highest during the 2007/2008 winter season (NPS 2010o).

VISITOR ACTIVITIES

Activities such as snowmobiling, cross-country skiing, and riding snowcoaches are primary winter uses in Yellowstone. These activities allow visitors to view wildlife and take photographs in various areas throughout the park and enjoy the sounds of the natural environment. Other popular uses include camping, hiking/snowshoeing, and participating in interpretive programs. Plowed roads, which permit vehicular movements, are few but they provide scenic drives with beautiful landscapes and vistas. These visitor activities are generally available throughout the winter season, but the park superintendent may restrict use of any area or trail to protect visitors and park resources. Weather conditions may also warrant closing an area.

The ability for visitors to experience Yellowstone by OSV is determined, in part, by the amount of snowpack on designated routes. The variability of snowpack over numerous years helps identify realistic opening and closing dates for OSVs in the park. Rubber tracked coaches can operate in low snow conditions. Snowmobiles and steel-tracked coaches are not allowed to operate when snow is too thin. Actual opening dates for non-rubber tracked vehicles is often later than the scheduled dates shown in table 26. For example, Snowpack at Madison Junction helps dictate when the road can be opened from Old Faithful to West Yellowstone. Approximately 15 to 18 inches of cumulative snowfall is necessary to open the west-side roads to OSV use. Spring closings closely mirror changes in the snowpack, specifically when it all becomes the same temperature, marking the beginning of spring melt. Mid-winter melt can also be a problem for maintaining snow on roadways; therefore mid-winter melt affects visitor use (Farnes and Hansen 2005).

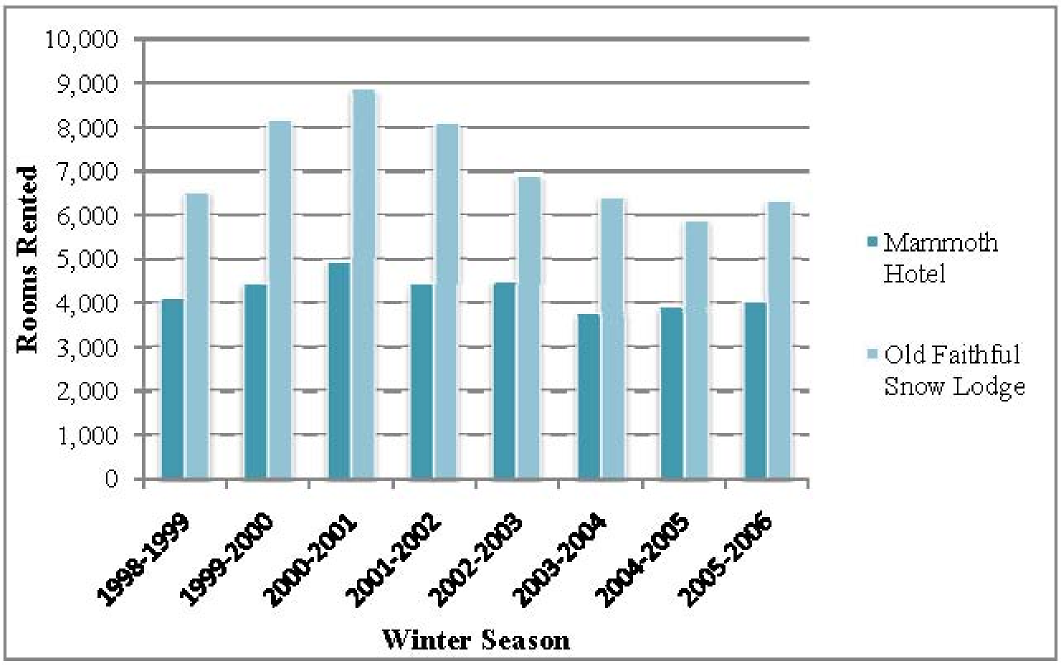
TABLE 26: OPENING DATES OF ENTRANCES

Entrance	Date of Opening
North	Open year-round
South	December 15
East	December 22
West	December 15

In addition to parking facilities dispersed throughout the park, there are warming huts at various locations. Warming huts are found at Mammoth, Canyon Village, Indian Creek, Fishing Bridge, Madison, and West Thumb. Small snack bars or vending machines are available at the warming huts at Mammoth, Madison, and Fishing Bridge. NPS interpreters or volunteers staff some of the huts to answer questions and provide information and assistance to visitors. Winter fueling facilities are available at Old Faithful, Fishing Bridge, Mammoth, and Canyon Village (NPS 2007c).

Winter lodging facilities in the park include the Mammoth Hotel and the Old Faithful Snow Lodge. Together, these hotels have 228 rooms with 448 beds (NPS 2007c). In addition to these facilities, Yellowstone Expeditions operates six yurts plus a dining/community yurt and kitchen yurt near Canyon Village. The park also issues winter backcountry camping permits. Overnight stays at the hotels were at their highest during the 1999/2000 to 2001/2002 winter seasons (figure 13). The change in hotel stays closely parallels fluctuations in overall Yellowstone winter visitation. Snowmobile use and recreational visitor numbers were at their highest during these years.

Snow Lodge



Source: NPS 2007c.

FIGURE 13: HOTEL ROOMS RENTED IN YELLOWSTONE NATIONAL PARK, VARIOUS WINTER SEASONS

There are a number of museums in the area that offer a variety of different opportunities to learn about the history and heritage of the park and region. The Heritage and Research Center in Gardiner, Montana, houses the Yellowstone National Park museum collection, archives, research library, historian's office, archeology lab, and herbarium. Other nearby education resources include the Buffalo Bill Historical Center, the Carbon County Historical Society & Museum, the Eagle Rock Art Museum, the Gallatin County Historical Society and Pioneer Museum, the Museum of the Mountain Man, and the Museum of the Yellowstone, among others.

VISITOR SURVEYS

Numerous studies have examined visitor use in national parks, including some specific to Yellowstone, in an attempt to understand features and elements of particular importance to different user groups. Managing OSV use can affect visitor experiences in the park directly and indirectly. The NPS directly controls several elements of OSV travel, including limits on the number of OSVs in the park each day, the size of snowmobile tour groups, the relative proportion of snowmobiles and snowcoaches allowed, the grooming of roads, and requirements for visitors to employ licensed guides and use snow machines equipped with BAT. Through these actions, the NPS also manages other aspects of OSV use that can affect the experiences of winter visitors. Much of the research that has been done addresses how noise can impact the visitor experience, however, studies on the role wildlife viewing plays in the visitor experience and the potential for visitor conflicts are also relevant to winter use in the park.

Soundscapes are a key element of the environment and natural ecology of national parks (Borrie et al. 2002; Bowles 1995). However, equally important are the ways in which visitors experience a natural soundscape (McCusker and Cahill 2010). Much of the social science research on soundscapes addresses the effects of noticeable natural and anthropogenic sounds on visitor experiences in national parks and other natural areas. This has been an important area of investigation during the last two decades. In general, social science research has found that the majority of visitors to national parks value and enjoy natural sounds, solitude, and quiet (Mace et al. 2004). At Yellowstone, a 2008 study found that those interviewed believed the natural sounds they heard were part of what made Yellowstone special. Eighty-one percent of respondents indicated that natural sounds had a positive effect on their experience (Saxen 2008).

The visitor survey report summarized below is the most recent available report of its kind. Data below was collected during the 2007/2008 winter season. The report, entitled *Winter Experiences of Old Faithful Visitors in Yellowstone National Park*, was prepared by The University of Montana, Department of Society and Conservation and released in August 2009 (Freimund et al. 2009). The methodology employed for this study was designed to address the following objectives related to noise and the visitor experience: to better understand the dynamics of visitor experiences of natural sounds and to better understand visitor perceptions of the practical need for mechanical sound presence during a park visit. Additionally, the study examined the relationship between visitor experience and wildlife and guiding.

The soundscapes sub-study sought to describe the dynamics of winter visitors' experiences of the soundscape environment in Yellowstone and document how visitors feel natural soundscapes should be protected by park management. Interviews conducted for the survey revealed that the natural soundscape assists in providing a deep connection to nature that is restorative and even spiritual for some visitors. Natural sounds influenced respondents' motivation to visit Yellowstone and were an important part of the experience for more than a third of the visitors interviewed. Specifically, experiencing natural sounds during a visit was rated as "extremely" or "very" important by 85% of cross-country skiers, 81% of snowshoers, 75% of snowcoach tourists, but only 55% of snowmobilers.

Slightly less than half of respondents said the park was particularly attractive as a place free from motorized noise. Overall, snowmobilers and snowcoach riders generally felt strongly or somewhat agreed that Yellowstone is a place for natural quiet. Because they are able to travel in different locations than motorized vehicles, survey respondents participating in non-motorized winter activities, such as cross-country skiing and snowshoeing, had a higher percentage of respondents indicating they believe the park is a place free of motorized noise (even though they all had to use OSVs to access Old Faithful). Overall, Freimund et al. (2009) report that 71% of respondents to the soundscape survey said they found the level of natural sound they were looking for half or more of the time they desired it, but only 15% of visitors were able to find these experiences all of the time they were in the park. Still, very few respondents (8%–

13%) in all groups supported closing the roads at Yellowstone to all OSVs. Somewhat greater support existed for closing roads to snowmobiles while allowing snowcoach tours to continue; but fewer than half of all groups strongly or somewhat supported this measure, and only 11% of snowmobilers supported it.

The majority of respondents supported requiring BAT vehicles, continuing guide requirements, limiting the total number of snow machines in the park per day, and limiting group size to 11 per guide. The closing of roads to all OSVs or to snowmobiles only was opposed or strongly opposed by the majority of respondents. Plowing the roads for automobile access was also strongly opposed by approximately 71% of respondents.

In addition to these most recent studies, the effect of noise on the visitor experience has been examined at the park since the late 1990s. In a study before managed winter use, Davenport et al. (2000) found that most visitors "treasured" their winter experience in the park, with the peace and quiet part of that experience, with a high level of visitor satisfaction. Littlejohn (1996) also conducted a study in the "pre-managed era" and found that in response to an open-ended question about what they liked least about their visits, 134 respondents replied that trails and roads needed grooming, but only 79 respondents replied that noise from snowmobiles was what they liked least. Borrie et al. (1997) also explored the impact of noise on the quality of the winter experience at the park during the pre-managed era. In this study, visitors tended to describe the noise impact as neutral (neither important nor not important). More recent studies (Freimund et al. 2009; Saxen 2008) of visitor satisfaction during the "managed era" at the park reported similar findings, as detailed above and in the Scientific Assessment of Yellowstone National Park Winter Use.

Wildlife Viewing and the Visitor Experience

Many studies have noted the importance of wildlife viewing as part of the visitor experience in the park (Freimund et al. 2009), with bison being the most viable animals in the park. A second sub-study of the 2007/2008 survey looked at the visitor experience and bison. This study was conducted to explore snowcoach, snowmobile, and cross-country skiing winter use visitors' opinions of the human-bison interactions witnessed during park visits and to analyze situational and visitor characteristics that might influence those opinions. Four hundred eleven visitors were surveyed at the park. From these surveys, Freimund et al. (2009) found that 71% of winter visitors to the park believed their opportunity to view bison was "very" or "extremely" important to their visit. When comparing cross-country skiers, snowshoers, snowmobilers, and snowcoach users, 70% or more of all groups rated the importance of the opportunity to view bison as very important or extremely important.

The majority of respondents indicated that the bison they encountered did not seem to notice the presence of humans or OSVs or, if they did, they quickly resumed their activities. Less than 20% of respondents had interactions with bison where they witnessed a defensive charge or felt bison were hurried or put into flight. Specifically, when asked to describe the most significant or "intense" encounter with bison that they witnessed, 43% of visitors described responses no more intense than bison noticing the presence of humans and resuming their activity. Another 36% witnessed interactions in which bison appeared to be vigilant, to move away in an unhurried manner, or to have their desired movement blocked. The remaining 21% of visitors indicated seeing interactions where bison were hurried, put to flight, defensive toward humans, or appeared to fight each other as a result of human presence.

The survey found that snowmobilers were more likely to say bison were calm, as compared to cross-country skiers and snowshoers, who indicated that the bison appeared somewhat agitated and somewhat dangerous. Respondents traveling through the park via snowcoach were more likely to report that the bison appeared calm, as compared to reports from respondents using non-motorized transportation modes.

The majority of respondents still believe that bison lead a largely free, unrestricted life and remain an authentic symbol of western culture and heritage. Respondents indicated that they believe the bison appear healthy and they gave a positive endorsement in the case of appropriateness, quality of management, and acceptability of the bison.

Guiding

In addition to visitors, Freimund et al. (2009) also conducted interviews with 22 guides at the park. The study was designed to identify the perceptions snowmobile and snowcoach winter guides in Yellowstone have on the effectiveness of recent policy changes in achieving environmental protection while promoting satisfactory visitor experiences. At the time the study was conducted (2008), the daily limit on the number of snowmobiles in Yellowstone was 720 and it was the fourth winter that guides and BAT requirements had been in place. The number of snowcoaches and their requirements had remained unchanged since 2004.

Overall, guides thought that implementing policies requiring cleaner and quieter technology vehicles is beneficial to the ecology, improves the soundscape, and enhances visitor experience. The majority of guides felt that the visitor experience was enhanced because the presence of guides resulted in a more interpretive experience while also enforcing regulation and ensuring safety. The change in visitor characteristics observed by guides suggests that people come to Yellowstone to experience the natural environment as opposed to using it as a place to ride OSVs. Few felt that the guide requirement inhibited the visitors' and local residents' ability to enjoy the park in the way they choose.

Guides did not believe that smaller groups had an effect on wildlife, because there are numerous groups in the same area at the same time, negating the purpose limiting the size of groups. Additionally, they felt that sufficient lands exist surrounding Yellowstone accommodate unguided snowmobiling, and the park should be a place to enjoy nature and to be educated. The majority of guides felt that that 720 snowmobile per day limit was working well. Some snowmobile guides were concerned about road conditions and the 1/3 mile rule which states snowmobiles must stay a third of a mile behind the guide, and some snowcoach guides felt that snowmobiles should be removed from Yellowstone all together.

Conflict and the Visitor Experience

Conflicts caused by OSV use in Yellowstone could be due to several impacts: engine or track noise interrupting inspirational visitor experiences; vehicle congestion at popular locations and rest areas; incompatible styles of use; perceived differences between user groups in social status, values, or identity; and conflicts arising from perceived differences in support or opposition to NPS management actions. In some cases, this conflict could be "symmetrical" (i.e., recognized and experienced by all groups that are involved in the conflict). In other cases, the conflict may be "asymmetrical" in that it is perceived only by the impacted group, but not by the group or groups causing the impact (Adelman et al. 1982). A well-established definition of behavioral conflict in the recreation social science literature is "goal interference attributed to the behavior of another" (Ruddell and Gramann 1994). Two types of visitor conflicts, noise-based and identity-based, have been studied at Yellowstone.

As suggested by previous noise research, the probability of conflicts arising from visitors' annoyance with motorized sounds in Yellowstone may be highest in areas where the sounds are perceived as incongruent with the setting, such as in backcountry locations accessible only by ski or snowshoe. Expectations for experiencing tranquility, solitude, and low or zero human-produced sounds are common to backcountry users, forming an integral part of their anticipated experience and one of their primary reasons for visiting such locations (Manning et al. 2004). Based on noise modeling conducted for past winter use plans, mechanized noise may be audible to humans in areas up to 10 miles from travel corridors (Hastings et al. 2006). This means that most non-motorized visitors to the park could encounter OSV sounds during their visit. Cross-country skiers or snowshoers, who may travel by OSV to areas inaccessible to wheeled vehicles and then proceed on foot, would be most likely to notice such noise and experience conflict with OSV use (NPS 2008a), especially if they are seeking natural sounds and quiet once they reach their desired destination for skiing or snowshoeing. Active visitors might travel beyond the range of mechanized noise, but most users stay within two miles of travel corridors (NPS 2008a), putting them well within the audible range of OSVs.

According to Jacob and Schreyer (1980), four major factors contribute to conflict between individuals or groups in outdoor recreation: (1) differences in the level of significance attached to using a specific recreation resource; (2) differences in personal meanings assigned to an activity; (3) differences in expectations of the natural environment; and (4) differences in lifestyles. Information on whether winter user groups in Yellowstone believe they are in conflict with other identified groups in the park has not been systematically collected, however, information from other studies such as Freimund et al. (2009) can be used to inform this issue. During this study, similarities between OSV and non-OSV users were found, for example, all user groups believed natural sounds to be important to their experience and there was overall support for the use of snowmobiles and snowcoaches in the park. Similarities continued among user groups for the interpretation of bison-human interactions at the park (Freimund et al. 2009), indicating conflict did not exist between these groups. Other studies look at visitors based on their primary motivation for visiting the park in winter rather than their mode of transportation. Borrie et al. (1999) found the primary motivations at Yellowstone included “personal growth,” “quiet activity,” “nature study,” and “accidental.” The study found differences between these groups in terms of the park entrance they preferred, acceptability of encounters with other OSV users, and tolerance of difference scenarios of OSV use. However, snowmobilers made up a large segment of each group, suggesting a simple “mode of transport” segmentation may not reveal the most meaningful differences between visitors and their experiences at the park.

OTHER SURVEYS

West Yellowstone Snowcoach Study, Visitor Profile of Snowcoach Passengers in West Yellowstone, Montana (Nickerson et al. 2006)

This study by the Institute of Tourism and Recreation Research at the University of Montana profiled West Yellowstone snowcoach passengers in Yellowstone during a two-year study conducted from January to March in 2005 and 2006. Snowcoach passengers from five West Yellowstone companies were given a 2-page questionnaire to complete during the last five minutes of their trip back to West Yellowstone. The survey period was conducted over a two-year period, resulting in 266 useable questionnaires

Overall, travel groups were relatively large, with a mean group size of 4.4. Non-resident groups stayed an average of 5.67 nights away from home, while Montana groups stayed 3.23 nights. Those who stayed at least one night in West Yellowstone averaged 4.14 nights in the area. Non-residents’ reasons for being in the area were to visit Yellowstone in the winter (50%) and to ski at Big Sky (41%) compared to Montanans, 69% of whom said they came to visit the park and only 8% of whom indicated they came to ski at Big Sky. Of those who spent a night in West Yellowstone, 24% said snowmobiling was a reason for visiting the area. Primary reasons visitors wanted to visit the park in the winter included viewing wildlife in the winter, seeing winter wonderland scenery, and seeing geothermal activity in the winter. Respondents reported the snowcoach tour provided them with an appreciation of nature, an educational experience, and a sense of wonderment.

Study of Preferences and Values on the Bridger-Teton National Forest Study (Clement and Chang 2009)

Bridger-Teton National Forest (BTNF) conducted a survey of the preferences and values in relation to the forest. The forest is adjacent to the park and allows for a variety of winter uses. The Study of Preferences and Values on the BTNF report was designed to

- Conduct a random sample survey of local residents to explore their values and preferences in relation to the BTNF
- Better understand respondents' values associated with geographic aspects of the forest
- Conduct a Q-study, used as a research method to study people's "subjectivity" or their viewpoint, to explore the main values discourses that prevail regarding the BTNF with members of local communities who participate in the survey.

Participants in the survey included members of the general public who filled out the survey online, a group of cooperating counties, and soil conservation districts. Mailings were sent to 1,500 random households in the five counties surrounding the forest, with a 32% response rate.

Recreational activities in the BTNF enjoyed by the greatest percentage of participants include driving, wildlife viewing, fishing, hunting, and nature enjoyment. Participants were allowed to identify all recreational activities in which they participated in within the forest. Approximately 87% of respondents prefer to experience the forest through non-motorized recreational activities. Forty-four percent enjoy all-terrain vehicle use, 33% like the four-wheel driving experience, and 56% like OSVs.

Approximately 42% of respondents indicated they felt that the current level of motorized activity was appropriate, while approximately 37% felt there was a need to create more motorized road access either by opening roads that were closed or through the construction of new roads. Approximately 15% of respondents indicated that they believe the level of motorized road access should be reduced or eliminated. Additionally, 65% of respondents indicated that the current level of outfitter guide use (i.e., fishing, hunting, hiking, and snowmobiling) should be maintained. Approximately 48% of respondents indicated that no other areas should be designated as wilderness area.

Shoshone National Forest Study (An Economic Profile of the Shoshone National Forest, Taylor et al. 2008)

Shoshone National Forest (Taylor 2008) conducted a survey of public values and preferences for the counties bordering the forest in 2006. The forest is adjacent to the park and offers a variety of visitor activities. The survey inquired about the following:

- Familiarity with the Shoshone National Forest
- Forest use preferences
- Attitudes to important topics on the Shoshone National Forest
- What values respondents attach to the Shoshone National Forest, the intensity with which those values are held, and, using a map, places on the Shoshone National Forest that represent those values
- Demographic information.

A four-phase mailing was sent to 1,300 random households in Fremont, Hot Springs, Teton and Park counties. The surveys sent were split evenly between the counties according to zip codes. The mailing resulted in a response rate of 3%; of those responses, 69% included mapping data regarding valued places in the Shoshone National Forest. The survey results provided

- The forest values that residents around the Shoshone National Forest have in relation to that forest;
- The preferences and attitudes associated with uses and issues in relation to the Shoshone National Forest; and
- The places in the Shoshone National Forest associated with these resident preferences, attitudes, and values.

Responses were weighted according to the relative county population numbers. First, county populations were divided by the number of respondents from that country and that number was used to weight results. Recreational activities in the Shoshone National Forest enjoyed by the greatest percentage of participants include driving, nature enjoyment, wildlife viewing, fishing, hiking/backpacking, and hunting. Participants were allowed to identify all recreational activities in which they participated in the forest. Approximately 37% of respondents prefer to experience the forest through non-motorized recreational activities. Forty percent enjoy all-terrain vehicle use, 37% like the four-wheel driving experience, and 28% like OSVs.

Approximately 39% of respondents believed the level of existing road access was appropriate (recognizing that roads may be relocated or rehabilitated to protect resources). Nineteen percent believed there was a need for more motorized road access and 8% commented that the level of motorized open roads should be reduced. Thirty-four percent of respondents replied as being “very satisfied” with winter recreation experiences in the forest. Additionally, 72% of respondents indicated that the current level of outfitter guide use (i.e., fishing, hunting, and snowmobiling) should be maintained.

PREVIOUS STUDIES

Other studies have been conducted related to visitor use and experience in the winter at Yellowstone. However, most of these occurred prior to the managed era and have limited applicability for impact analysis. These studies are further described in the Scientific Assessment of Yellowstone National Park Winter Use.

VISITOR ACCESSIBILITY

As noted above in visitor use and experience, Yellowstone offers a wide variety of experiences in the park that can be experienced by a range of visitors. Visitors that could have difficulty accessing the park during the winter months include the very young, the elderly, and with those that are mobility impaired. Within Yellowstone, visitors with access challenges can drive through the north entrance of the park and through Lamar Valley and Mammoth in their own vehicles. Additionally, tour companies offer accessibility through the north entrance of the park through wildlife viewing tours in Americans with Disabilities Act (ADA) accessible vehicles (Xanterra pers. comm., 2010). Visitors can enjoy viewing wildlife and the natural surroundings from a wheeled vehicle. Depending on individual mobility challenges, for some,

Tour companies offer accessibility through the north entrance of the park through wildlife viewing tours in ADA accessible vehicles (Xanterra pers. comm., 2010). Visitors can enjoy viewing wildlife and their natural surroundings from a wheeled vehicle.

snowmobiles can provide a way for visitors to enjoy the park in the winter. For others, ADA-accessible snowcoaches are the preferred mode of travel. Companies work with visitors to provide the type of transportation that best meets their needs and desires. Commercial vendors at Yellowstone offer ADA-accessible snowcoaches for those with accessibility issues. According to one company, disabled visitors use the power-lift snowcoaches on average twice a month (Johnson pers. comm., 2010).

The Old Faithful Visitor Education Center and the Albright (Mammoth) visitor center are wheelchair accessible. Visitors with accessibility needs may require assistance to enter the Madison warming hut (NPS 2010i). Wheelchair accessible rooms are available at the Old Faithful Snow Lodge, which also offers a handicapped-accessible cabin for visitors. Trails, paths, and roads are snow covered in the winter. These routes are kept open, but soft or fresh snow may preclude easy access between the Snow Lodge, the Old Faithful Visitor Education Center, and the geyser basin boardwalks. At Canyon, the South Rim Drive at Artist Point offers a view of the Lower Falls (NPS 2010j). At the Mammoth Hotel, two handicapped-accessible rooms are available (NPS 2010k).

Visitors can also visit the park from afar. The park offers seven webcams for visitors to remotely view the park. These webcams include two at Old Faithful; one each at the Upper Geyser Basin, Mammoth Hot Springs, and the terraces at Mammoth Hot Springs; and two at Mount Washburn. Visitors can view these webcams at any time during the year (NPS 2010l).

Visitors requiring audio assistance have several services offered. Films shown at the Old Faithful Visitor Education Center include assistive listening devices and captioning. Films shown in other visitor center theaters meet some accessibility needs. Sign language interpreters are available for rangers programs, three weeks' advance notice. By October 2011, a public TTY (teletypewriter) service will be available in all major park areas (NPS 2010m).

Visitors requiring visual assistance can enjoy films at the Old Faithful visitor center with audio descriptions. The park newspaper, *Yellowstone Today*, is available in a Braille edition at visitor centers and large print text information is accessible on the park's website (NPS 2010l).

HEALTH AND SAFETY

Three primary health and safety issues regarding winter visitor use were identified and are addressed in this plan: the effect of motorized vehicular emissions and noise on employees and visitors, avalanche hazards, and safety problems where different modes of winter transport are used in the same place or in close proximity.

In the last 15 years, the NPS (both nationally and in Yellowstone) has become concerned about providing safe work environments for all employees. In part, the agency's concern was heightened after the Occupational Safety and Health Administration (OSHA) found more than 600 safety violations in Yellowstone in 1997. Yellowstone's injury rate was two to three times as high as even that of industries known to be risky, such as oil and gas drilling. In response to this problem, Yellowstone partnered with OSHA to improve employee safety. With OSHA's assistance, the NPS has improved workplace safety, an improvement reflected in an overall drop in employee injuries. The NPS remains committed, as does the Department of the Interior, to providing safe work places, with a goal of no lost time accidents for its employees

PERSONNEL AND OCCUPATIONAL EXPOSURE TO CONTAMINANTS

Air Quality

Although managed use of OSVs has reduced health and safety issues related to OSV accidents over the years, health and safety issues related to the noise and air emissions from OSV use remain. Historically (pre-four-stroke engine technology), snowmobiles in national parks have been a major source of air pollution, including carbon monoxide (CO), which is emitted as a byproduct of incomplete combustion of carbonaceous fuels (e.g., gasoline, diesel) (Flachsbart 1998). After inhalation into the body, a CO molecule binds with hemoglobin (Hb) in the blood to form carboxyhemoglobin (COHb) and can cause headaches, nausea, and irritation when exposure is over the National Institute for Occupational Safety and Health (NIOSH) peak level (Flachsbart 1998; NPS 2005c). In a summer 2005 study at Yellowstone, peak CO levels were associated with older, un-tuned vehicles and/or motorcycles that were idling for several minutes at the entrance station window (NPS 2005c). Formaldehyde, another contaminant associated with snowmobiles and snowcoaches, is classified as a proven carcinogen (group 1) by the International Agency for Research on Cancer. NIOSH has a recommended exposure limit (REL) of 0.016 ppm (8-hour time-weighted average (TWA)) but also recommends that exposure to carcinogens be as low as technologically feasible (USDOI 2009).

Numerous occupational air quality studies have been conducted at Yellowstone, focusing on the west entrance, the busiest winter access point to the park for OSV access. The major objective of these studies was to evaluate NPS employee exposure to PM, air contaminants, and noise emitted by snowmobiles. The studies were performed during anticipated peak levels of snowmobile use in an attempt to obtain worst-case measurements during winter use work activities. Most sampling was completed during the busiest winter weekends in the park, for example the Martin Luther King three-day weekend and the President's Day three-day weekend.

Some of these studies, conducted when unlimited two-stroke machines were allowed, indicated concerns regarding employee safety and health, particularly on days with atmospheric inversions. Because snowmobiles entering the west entrance are now BAT with reduced numbers, exposure levels to a variety of chemicals have dropped appreciably, as shown in the following tables. In 1997, personnel exposure measurements for carbon monoxide were conducted at the west entrance (Radtke 1997). The 8-hour TWA for carbon monoxide was between 2 and 4 parts per million (ppm). The OSHA permissible exposure limit (PEL) is 50 ppm and the threshold limit value (TLV) is 25 ppm. The more restrictive 8-hour NAAQS is 9 ppm. The study concluded that carbon monoxide did not appear to be an important hazard for employees at the west entrance.

In 2000, OSHA conducted personnel and area sampling for benzene, gasoline, formaldehyde, and carbon monoxide. They concluded that exposures were below PELs and TLVs, except for exposure to benzene, formaldehyde, and carbon monoxide which exceeded the NIOSH REL for one employee at the west entrance express lane.

A 2001 study included personnel exposure monitoring for respirable PM, carbon monoxide, formaldehyde, acetaldehyde, and benzene. The study recorded an average benzene level of 0.035 ppm and an average overexposure of 0.029 ppm to benzene (Kado et al. 2001). Measured levels of benzene were below OSHA PEL and NIOSH REL levels. For formaldehyde and acetaldehyde, concentrations of 0.072 ppm and 0.024 (respectively) for a 170 minute sampling period were measured, which is also below OSHA PEL and NIOSH REL levels. Average particulate levels were measured at 0.1 mg/m^3, also below OSHA PEL and NIOSH REL levels. In 2004, after the managed OSV program was in place, occupational exposures to aldehydes, VOCs, respirable PM, carbon monoxide, and noise were evaluated. This study concluded that concentrations of all airborne contaminants were well below current standards and RELs (IHI Environmental 2004).

A 2005 study evaluated exposures at the west entrance for aldehydes, VOCs, total hydrocarbons, elemental and organic carbon, oxides of nitrogen, carbon monoxide, and respirable PM. All employee exposures to the above air contaminants and noise were below OSHA PELs and other RELs. During this study, a ventilation survey was performed in kiosks A and B at the west entrance. The survey showed that both kiosks were under strong positive pressure. At the time of the survey both kiosks were achieving slightly over one air exchange per minute with the window open 30 inches (Spear and Stephenson 2005).

Spear, Hart, and Stephenson conducted a similar study in 2006 (Spear et al. 2006). Although there were some minor variances, the 2006 report confirmed employee exposures below all current standards set by regulatory agencies except for 2 of 13 benzene samples (mean concentration of 0.0032 ppm). The minimal risk level for chronic-duration inhalation exposure (365 days/year) is 0.003 ppm for benzene; the intermediate-duration inhalation exposure is 0.006 ppm and the PEL is 1.0 ppm. Although the two benzene samples averaged slightly higher than the minimal risk level, employees would have to be exposed to these levels every day of the year (which they are not) for a concern to be present. Rather, the two samples that were higher than 0.003 ppm were short-term samples collected to minimize dilution effects and thereby portray potential worst-case exposures. In addition, one of the tradeoffs in converting to BAT is that four-stroke machines produce more benzene (and some other hazardous air pollutants) than the two-stroke engines used historically (Air Resource Specialists, Inc. 2006). Although Spear, Hart and Stephenson found no correlation between VOC concentrations and the number of vehicles entering during their 2005 and 2006 studies, there were fewer than 250 snowmobile entries on the days with higher benzene exposures. However, recent benzene exposure levels are an order of magnitude lower than they were when two-stroke machines were allowed in the park—a decrease possibly attributable to fewer numbers of snowmobiles. Overall, emissions are well below federal safety levels; monitoring and adaptive management activities will continue.

In 2009, air monitoring for snowmobile and snowcoach exhaust was conducted at the West Yellowstone entrance station over President’s Day weekend. Monitoring showed carbon monoxide slightly elevated from 2008 readings, but still below occupational exposure limits. On one sample day, snowcoaches and snowmobiles were separated. The exposure results showed carbon monoxide was slightly higher over the sampling period for snowmobiles; however, the peak reading for carbon monoxide was higher for the snowcoaches (the sample period included 19 snowcoaches and 221 snowmobiles). The elevated levels of CO were likely due to the absence of ventilation in booths (USDOI 2009). Otherwise, exposure levels to other pollutants measured were similar. An exposure assessment of the entrance station employees was also conducted in 2008. Results of VOC testing showed most levels were below detection limits, with the relative highest exposure being to benzene, which was approximately 2% of the OSHA PEL. Three of the nine aldehyde samples had detectable levels of formaldehyde. These measurements were only approximately 2% –3% of the OSHA PEL. Maintaining adequate positive pressure ventilation and minimizing time outside of the kiosk when snowmobiles and snowcoaches are idling will keep these exposures low (USDOI 2008).

Noise Exposure

Noise associated with OSV use can also have cognitive effects on both park staff and visitors. Noise has a range of effects on performance, and the effects are dependent on the type of noise and the demands made by the task. Noise exposure was measured for both snowmobile riders and employees working at the west entrance in studies conducted between the years 1997 and 2005. The exposure measured included noise from all sources, including snowmobiles and other equipment. One way to measure employee exposure to noise, as below, is to compute the eight-hour TWA of their exposure to noise, with hearing protection required when the TWA is above 85 dBA.

In 1997, personnel exposure measurements for noise were conducted at the west entrance. The 8-hour TWA for the noise samples ranged from 70.9 dBA to 82.0 dBA. These levels are below the action level of 85 dBA and the OSHA PEL of 90 dBA. The study concluded that noise did not appear to be a major hazard for employees at the west entrance (Radtke 1997). A 2000 OSHA study conducted personnel and area sampling for noise. The study concluded that exposures were below PELs and TLVs, but the express lane employee was overexposed to the American Conference of Industrial Hygienists (ACGIH) action level for noise of 85 dBA. The only noise overexposures to west entrance employees occurred when two-stroke machines were allowed.

In 2004, after BAT limits and commercial guiding were in place, occupational exposure to noise was evaluated with the conclusion that exposure did not exceed recommended limits. In 2005, another study at the west entrance concluded that noise exposures were below OSHA permissible limits and other recommended maximum exposure levels (Spear and Stephenson 2005).

A recent study found that employee noise exposures at the west entrance averaged 60.6 dBA for the winter 2004/2005 and 65.2 for the following winter, or 3.5% and 5.5% of the allowable noise exposure, respectively. Peak 8-hour TWAs for those two winters were 75 and 80 dBA, or 12.5% and 26.0% of the allowable exposure, respectively (Jensen and Meyer 2006). Clearly, although employees are exposed to some noise, those exposures are well within safeguards.

Since the change to four-stroke technology, employee exposure at the west entrance has been below 85 dBA. Snowmobile rider exposure levels have also decreased with the use of four-stroke technology, but rider exposure levels remain over the OSHA action level when operated for more than four hours. As noted earlier, 98% of loud OSV sounds are from coaches. Even new coaches can have high interior and exterior noise levels. A 2010 Glaval coach was tested in March 2010. At cruising speed (21 mph), it measured 73 dBA on the outside and 83 to 84 dBA on the inside. At top speed, 28 mph, the Glaval measured 77 dBA on the outside and 86 dBA on the inside (Burson pers. comm. 2010b). Noise exposure while riding on or in snow machines can be controlled with standard ear plugs, which are provided by snowmobile and snowcoach operators to users entering the park. All commercially available NIOSH-rated foam plugs provide enough attenuation to protect employee hearing. For the park, an estimated exposure of 77 dBA for 8 hours when wearing earplugs falls within acceptable exposure limits set forth by OSHA, NIOSH, and ACGIH.15.

The OSHA hearing conservation standard (29 CFR 1910.95) states that employee exposures should not exceed the peak, or maximum level of sound, of 115 dBA for more than 15 minutes. OSHA also recommends that employees never be exposed to impulsive or impact noise that generates sound levels greater than 140 dBA. No noise sampling in the park has indicated a maximum exposure above 115 dBA.

Further information on the impact of noise and its impacts to motor abilities is provided in the Scientific Assessment of Yellowstone National Park Winter Use. Average and maximum exposure levels at the west entrance are summarized in tables 27 and 28.

TABLE 27: AVERAGE PERSONNEL EXPOSURE TO SOUND LEVELS

Sample Description	Kiosk A	Kiosk B	Kiosk C	Rider Average
Radtke 1997 – no snowmobile count taken, mostly two-stroke sleds through west entrance	70.9 dBA	Not sampled in 1997	Not sampled in 1997	Not sampled in 1997
OSHA 2000 – 976 two-stroke sleds through west entrance	72.1 dBA	75.2 dBA	88.3 dBA	93.1 dBA riding two stroke snowmobile
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	62.9 dBA	68.8 dBA	Not used during 2004	82.4 dBA riding four stroke snowmobile
Spear and Stephenson 2005 – average of 180 sleds, primarily four-strokes through west entrance	60.6 dBA	Not sampled in 2005	Not used during 2005	85.5 dBA riding four stroke snowmobile
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily four-strokes through west entrance	71.3 dBA	71.0 dBA	Not used during 2006	Not used during 2006

Dosimeter settings set to evaluate compliance with OSHA Hearing Conservation Amendment (threshold = 80 dB; exchange rate = 5 dB Criterion Level = 90 dB; Time Constant = slow). Results are A-weighted.

TABLE 28: MAXIMUM EXPOSURE TO SOUND LEVELS

Sample Description	Kiosk A	Kiosk B	Snowmobile Riders
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	114.0 dBA 108.3 dBA 106.6 dBA 89.6 dBA 106.8 dBA 97.8 dBA	112.5 dBA 112.8 dBA 108.3 dBA 103.8 dBA 108.3 dBA	110.3 dBA 111.6 dBA
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily 4 strokes through west entrance (P) Denotes personnel sampling; (A) Denotes area sampling	109.0 dBA (P) 96.0 dBA (A) 105.0 dBA (A) 114.0 dBA (P) 112.0 dBA (A) 109.0 dBA (A) 110.0 dBA (P) 104.0 dBA (A) 111.0 dBA (A)	113.0 dBA (P) 94.0 dBA (A) 110.0 dBA (A) 108.0 dBA (P) 96.0 dBA (A) 107.0 dBA (A)	

AVALANCHE HAZARDS

NPS staff conducts avalanche control operations in the park as needed. Routine forecasting and control occurs only on the east entrance road to maintain Sylvan Pass for OSV travel; additional forecasting and control work may occur as a component of the spring road opening process, such as at Dunraven Pass, and in emergencies such as search and rescue operations. Although spring road opening operations and park emergencies may require avalanche control, those operations are outside the scope of this draft plan/EIS. This discussion focuses on operations at Sylvan Pass, but also discusses parkwide operations and the Talus Slope area on the south entrance road.

Avalanche control at Sylvan Pass has long represented a safety concern to the NPS. Sylvan Pass is an approximately one-mile-long portion of the east entrance road that splits the Absaroka mountain range near the eastern edge of the park. The pass connects the park's east entrance with Lake Village and goes between Top Peak on the south and Hoyt and Avalanche peaks to the north. Sylvan Pass is situated at an elevation of 8,530 feet and receives a great deal of snow in the fall, winter, and spring. It is extremely windy and its nearly 45-feet slopes are prone to avalanches (Comey 2007). There are approximately 20 avalanche paths that cross the road at Sylvan Pass. They average over 600 feet of vertical drop, and the east entrance road crosses the middle of several of the paths, putting travelers at risk of being hit by an avalanche and swept down the slope.

Since 1973, avalanche hazard mitigation work has been conducted on Sylvan Pass to accommodate snowmobile and snowcoach traffic (Yochim pers. comm. 2005). Historically, Sylvan Pass has been closed multiple times during a season for several hours to a full day during the winter to allow avalanche management to occur. That is, the pass has almost never been open for the entire season. Most reasonable avalanche mitigation techniques would result in the pass being closed for at least some days in the winter to conduct avalanche mitigation. Past winter planning documents concluded the health and safety risks of operating an avalanche control program in Yellowstone at Sylvan Pass are considerable. These risks have become better known in recent years, with at least two agencies (OSHA 2001; State of Montana, Department of Military Affairs 2004) examining and explaining some of the risks the NPS incurs in its avalanche control program. Use levels have always been relatively low at Yellowstone's east entrance. Even during the highest winter use years in the 1990s, total use for the season rarely exceeded 5,000 people, less than 5% of Yellowstone's total winter visitation.

These concerns led the NPS, in its 2007 winter planning decision, to close Sylvan Pass. However, in that decision, the NPS agreed to work with the City of Cody; Park County, Wyoming; and the state of Wyoming to determine the future of OSV travel over Sylvan Pass. These three entities and the NPS, formed the Sylvan Pass Study Group and met a number of times in 2008. The meetings resulted in the Sylvan Pass Agreement in June 2008.

The Sylvan Pass Study Group recommended to the Intermountain Regional Director of the NPS that Sylvan Pass be kept open in future winter use seasons to motorized and non-motorized oversnow travel between December 22 and March 1. The group recommended continued use of a combination of avalanche mitigation techniques, including forecasting and helicopter and howitzer dispensed explosives.

This recommendation to operate within a defined core season will reduce risk, improve safety, and maximize visitor access. The Sylvan Pass Study Group reached agreement based on the following guiding principles:

- That the safety of visitors, guides and NPS employees is the first priority in any avalanche mitigation operation on Sylvan Pass.
- That snowmobile and snowcoach motorized oversnow winter use access should be as regular and predictable as possible given weather constraints.
- That regular communications between the park, the City of Cody, Park County, the state of Wyoming and the Cody community is a key ingredient of any future winter operations on Sylvan Pass.

The City of Cody, Park County, and the state of Wyoming agreed, in good faith, to work cooperatively to explore funding of safety and access improvements. The members of the Sylvan Pass Study group agreed to establish consistent ongoing communications regarding Sylvan Pass winter use operations. The NPS agreed to make funding for safety and access improvements on Sylvan Pass a priority.

The agreement guided management of Sylvan Pass during the 2009 interim rule. Under the agreement, the park may use a combination of techniques that have been used in the past (howitzer and helicopter), as well as techniques that may be available in the future. Area staff may use whichever tool is the safest and most appropriate for a given situation, with the full understanding that safety of employees and visitors comes first. Park staff make the operational determination when safety criteria have been met and operations can be conducted with acceptable levels of risk. The NPS will not take unacceptable risks (figure 14). When safety criteria have been met, the pass will be open; when they have not been met, the pass will remain closed. Extended closure of the pass may occur.

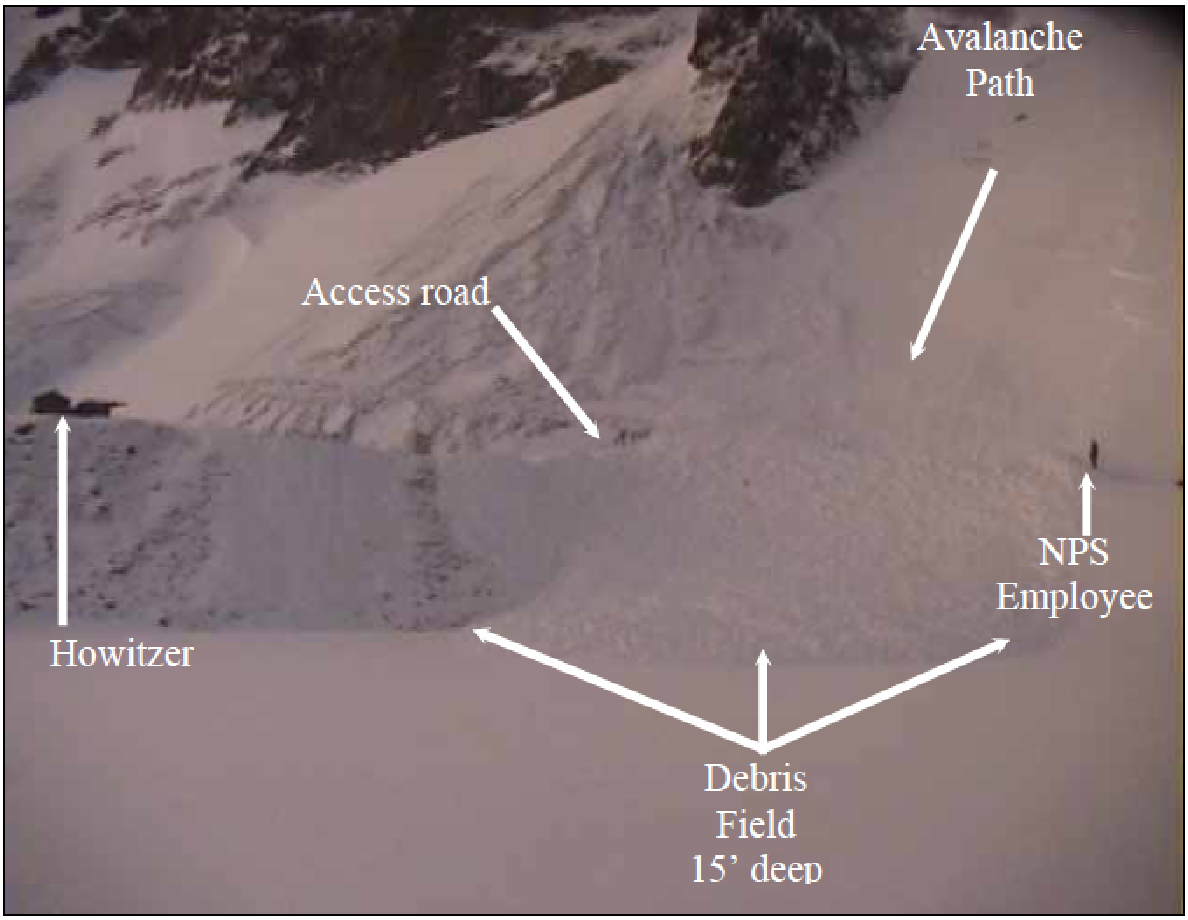


FIGURE 14: AVALANCHE THAT CROSSED THE ACCESS ROAD TO THE HOWITZER PLATFORM

Sylvan Pass Avalanche Forecasting and Hazard Mitigation Program

Prior to and since the Sylvan Pass Agreement, the NPS has adopted several mitigation measures to reduce the dangers to its employees and visitors:

- Installing a radio repeater on Top Notch Peak to improve communications in the pass area
- Providing additional, extensive, ongoing avalanche and howitzer training so that skilled staff perform control missions
- Conducting additional avalanche forecasting on site

- Constructing a berm above the howitzer platform to catch rock and cornice fall from the cliff behind it
- Realigning the east entrance road to reduce avalanche danger from some of the paths
- Modifying access to the gun mount to be farther from avalanche paths
- Acquiring a second howitzer (with the help of Wyoming)
- Having an enclosed vehicle available on site to support avalanche operations (again through assistance from Wyoming)
- Adding staff
- Adding additional weather equipment to improve forecasting (NPS 2011n).

The following is a discussion of the avalanche mitigation procedures summarized from the recent Operational Risk Management Assessment report (NPS 2010n).

Communication and Documentation

Road conditions are reported daily to the Yellowstone Communications Center. Changes in road status are sent via email and forecasters brief the Sylvan Pass staff on potential changes in weather. Following daily avalanche briefings, the weather forecast is updated. Discussions are posted for review by all staff working at Sylvan Pass. Forecasters complete documentation of avalanche hazard mitigation missions, natural avalanche occurrences, and snow observations. Regional Avalanche Forecast Centers provide the park with general condition reports and advisories. Forecasters for Sylvan Pass contribute site specific observations to regional centers.

Weather Forecasting

The Sylvan Pass Avalanche Forecasting and Hazard Mitigation Program begins and ends with weather forecasting. Each day a weather forecaster and an assistant check the weather for wind speeds, 24-hour snowfall, and air temperature. They also check for snowpack instability, visibility for driving, road conditions, weather factors, and any changes from the last observation. Weather factors include recent strong winds, recent heavy snow or rain, water content exceeding one inch from last observation, sudden warming (+12 to 15°F over 12 hours), recent wind loaded slopes, and localized areas of convexity, especially with thin snowpack and rocks underneath. The team practices open communication, teamwork, and safe travel practices. Forecasters use remote automated weather stations and SNOTEL (SNOwpack TELemetry) sites that provide hourly updated information to track weather influences on avalanche formation. The most useful stations are placed near a potential avalanche location.

Loaded slopes can occur when rain or snow has fallen in the past 48 hours or when one inch of snow per hour for the past 6 hours has fallen on or near the pass. Both terrain features and high winds can contribute to a higher chance of an avalanche. If the team decides to close the pass, the road will remain closed until the avalanche hazard has decreased or been mitigated, signs indicate increased stability, and visibility improves. After avalanche mitigation is complete, a road groomer smoothes the road surface to allow for OSV travel. At this point the forecaster will make the determination whether to re-open based on current and predicted conditions.

The Process of Avalanche Mitigation

When a decision is made to conduct an avalanche mission, avalanche mitigation begins with ensuring that current, trained staff are available. If it is a howitzer mission, artillery training, hazardous material training, and proper experience of all team members is required. A crew is assembled from Lake and east entrance, and other districts, and the avalanche hazard is assessed by an avalanche forecaster. This assessment is used to determine the potential effectiveness of using the howitzer and the ability of personnel to safely access the gun mount. The Go/No Go decision may be based on the potential for avalanches to reach or cross the road along the west side of the avalanche zone. The decision to proceed is determined by the forecaster with consensus of the howitzer crew. The method of accessing the gun mount will vary based on the evaluation of the avalanche hazard, conducted by the avalanche forecaster.

Prior to the howitzer mission, a briefing is conducted outside the avalanche zone and the access route and other operational considerations are reviewed with the howitzer team. During the howitzer mission, approximately 20 rounds are fired into the starting zones of the avalanche paths, depending on snow conditions and observed results. At the conclusion of a mission, if conditions are safe, a groomer rebuilds the snow road to make it passable for OSVs. The groomer operator also has basic avalanche safety training, and the forecasters and other staff maintain a close watch during the grooming to watch for unexpected releases of snow. A single avalanche control mission requires a 10-hour work day for five to seven specially trained employees.

The park works closely with other regional avalanche forecasters to compare Sylvan conditions with those being observed in the vicinity of the park. The park is also a member of the Avalanche Artillery Users of North America Committee, has adopted their M101-A1 Howitzer Avalanche Control Firing Manual, and attends the annual Avalanche Artillery Users of North America Committee meeting to stay current on nationwide avalanche management.

The howitzer is on loan from the U.S. military, and the Wyoming National Guard assists with annual maintenance and training.

A contract helicopter may be used instead of a howitzer, especially when access to the howitzer is unsafe. NPS employees are not aboard the helicopter and do not drop the explosive charges. That is the role of the contractor. NPS employees brief the pilot and crew, and the pilot and crew make the decisions about where to drop the charges. As with howitzer missions, an NPS groomer rebuilds the road, and the east entrance road may be re-opened for public and administrative travel. Figure 15 shows avalanche paths at Sylvan Pass.

Unexploded Ordnance

Unexploded ordnance at Sylvan Pass presents many more concerns, both for public safety and regarding homeland security. Over the years, unexploded ordnance has accumulated, primarily from past use of a 75-mm recoilless rifle for control work. The total number of unlocated unexploded ordnance is estimated at 300. Six unexploded ordnance have occurred in the past two winters from both helicopter and howitzer operations; three were recovered and three have not been recovered. The ammunition used contains a mixture of explosives that is highly toxic to humans and the environment. Both exploded and unexploded ordinance have the potential to release toxic materials (State of Montana 2004). The fate of the partially unexploded and unexploded ordnance and its toxic filler is unknown but of concern in the Sylvan Pass area. Visitors may come into contact the unexploded ordnance; for example, in 1997 a visitor picked up a round and transported the live shell into the Fishing Bridge Visitor Center to give to a ranger. Unexploded shells have also fallen onto the roadway (Comey 2007). When one did so in 2006, the roadway had to be closed for 24 hours while a military team was brought in to remove the hazard. On a larger scale, before the July 2004 mud and rock slide on Sylvan Pass could be removed from the road, the 10,000 cubic yards of material had to be laboriously searched for unexploded ordnance.

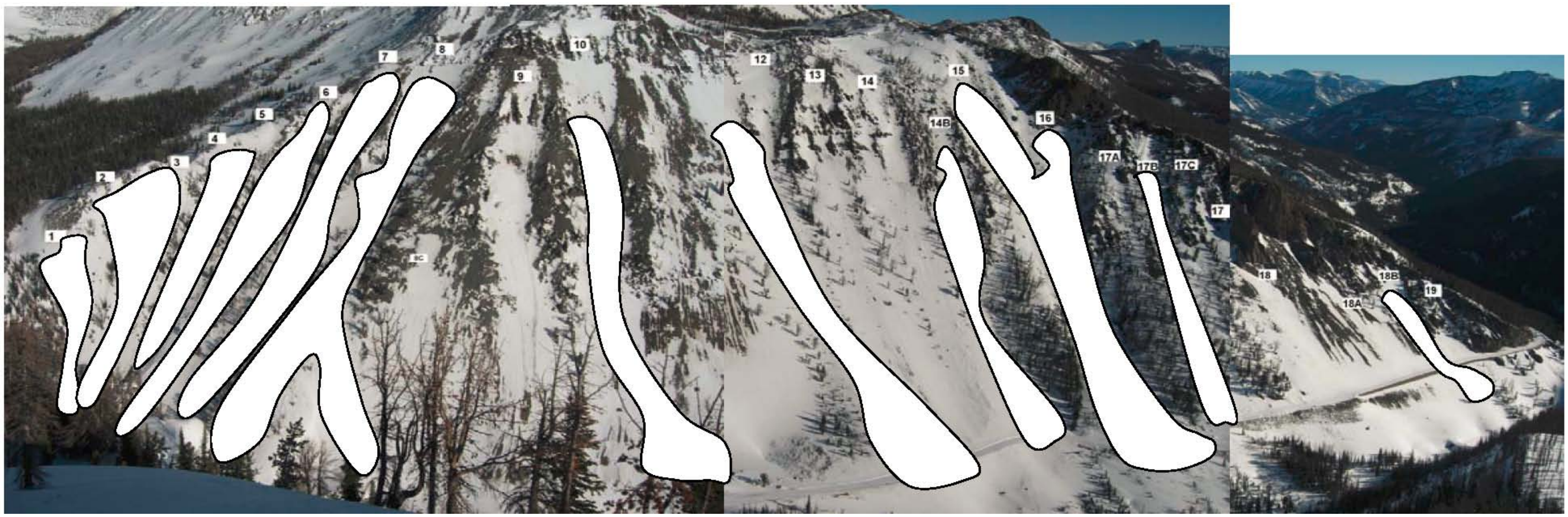


FIGURE 15: MAP OF SYLVAN PASS (AVALANCHE PATHS INDICATED BY NUMBER)

OSV Use in Sylvan Pass

Commercial OSV operators receive an orientation on safe travel practices through Sylvan Pass. Visitors can access the park website to check the status of open or closed roads, check for daily winter weather reports (including minimum and maximum temperatures, new snow accumulation, snow depth, weather, and an avalanche danger rating), and learn more about avalanche forecasting and hazards. A closure of Sylvan Pass occurs from 9:00 p.m. each night until 8:00 a.m. the next morning, when staff can make the operational determination for opening the pass.

Talus Slope

The "Talus Slope" area on the south entrance road also contains some avalanche zones. In contrast to those at Sylvan Pass, there are only seven avalanche zones, averaging less than a 200-foot vertical drop within a 1,700-foot section of the road. The south entrance road does not cross the avalanche paths, but rather the run-out zones attributed to the avalanches. If a vehicle were pushed off the roadway by a slide, it would drop about five to ten feet, a fall unlikely to be fatal. In cases where a vehicle has been caught in a slide at the Talus Slope, the slide has merely moved around the vehicle without moving it or coming close to covering it (Johnson 1999; NPS 2007b; Mossman 2003).

In the late 1990s, following a series of winters with above average snowfall, several avalanche-related deaths in the park, and the death of a ski-patroller at Big Sky related to hand-charge use (Livingston Enterprise 1997), park staff evaluated options for avalanche management at Talus Slope and elsewhere. The review recommended use of an avalauncher (rather than the hand-charges that had historically been employed) (NPS 2002b). After 2 to 3 seasons of avalauncher use (which included considering its use at Sylvan), further reviews of the avalanche situation at Talus occurred (NPS 2002c). Those extensive reviews, which included input from avalanche experts outside the NPS, concluded that the risk of substantial avalanche activity at Talus Slope was low under normal conditions (Mossman 2003; Johnson 1999) and that the risk to employee safety of avalaunchers misfiring substantially exceeded the expected risk of a life-threatening avalanche discharging at Talus Slope (Keator 2004). The review also concluded that avalanche risk there would be best managed through careful observation of snow and weather conditions, signs for the visiting public prohibiting stopping in the avalanche zone, possible structural designs, and use of helicopter-dropped explosives (Johnson 1999; NPS 2003a). In accordance with the review, park staff has continued to review the avalanche risk reduction program and, coincidentally, winters have brought lower snowfall amounts, producing little to no avalanche activity at Talus Slope.

For these reasons, park staff determined that avalanches in the Talus Slope area do not pose the same level of real and substantial risk to park employees and visitors as those at Sylvan Pass (Keator 2004; NPS 2007b). Even so, Yellowstone park staff monitor the Talus Slope area just as regularly, and with just as much vigilance, as they do other infrequent slide zones in the park. Should a heavy storm produce severe avalanche conditions, or should such conditions develop in other ways (as was documented in the 1999 report by Alan Sumeriski), park staff would close the roadways until conditions improve or until such avalanches could be discharged. The same policy applies to the numerous other roadside slopes in the park that are prone to slides given the right snow and wind conditions. Park policy is uniform for all locations: monitor (using both regional and site-specific information), close the road if conditions are unsafe, control for avalanches (currently with helicopter-dispensed explosives), and reopen when safe (NPS 2003a). No management changes are proposed for the Talus Slope, Dunraven Pass, other road segments, or for park backcountry areas with avalanche hazards.

SAFETY CONCERNS BETWEEN DIFFERENT MODES OF WINTER TRANSPORTATION

Winter use in Yellowstone occurs mainly on groomed park roads for cross-country skiers, snowshoers, snowmobilers, and snowcoaches. Past planning efforts have raised safety concerns between the use of non-motorized use and motorized use, including the concern that the use of a snowcoach or snowmobile on the same roadway as a cross-country skier or snowshoer could pose a threat to their health and safety. There are several established trails that are groomed specifically for non-motorized uses and are not accessible to motorized users, which could reduce this perceived conflict. Safety concerns are addressed in part, by the requirement for OSV use to be guided within the park.

Since the winter of 2004/2005, all snowmobilers have been led by commercial guides. Some visitors to Yellowstone have never ridden a snowmobile, and commercial guides help to teach how to safely travel through the park. Commercial guides are experts at snowmobile and/or snowcoach driving in Yellowstone and know the conditions that may be encountered with such travel. All commercial guides are trained in basic first aid and cardiopulmonary resuscitation. In addition to first-aid kits, they often carry satellite or cellular telephones and radios for emergency use. They also carry shovels and equipment necessary to respond to avalanches and to vehicles that may need to be pulled from a soft road shoulder. Commercial guides use a “follow-the-leader” approach, stopping often to talk with their group. They lead snowmobiles single-file through the park, using hand signals to pass information down the line from one snowmobile to the next. Signals are effectively used and warn group members about wildlife and other road hazards, indicate turns, and indicate when to turn the snowmobile on or off.

As shown in figure 16, introduction of commercially led snowmobile tours has reduced the number of law enforcement incidents since 2003/2004. Based on these raw numbers, OSV related incidents are down 90% from 2002/2003(282 incidents) to 2009/2010 (27 incidents). Although the number of violations related to OSV travel has been reduced, violations still occur, mostly unrelated to winter visitor recreation use. In 2009, four snowmobilers were apprehended when park rangers caught them riding in Yellowstone’s backcountry. The offenders were operating rented machines off trail, more than a mile inside the park boundary near West Yellowstone. The use of OSVs in the backcountry, on trails, and off-road has always been prohibited. Despite this prohibition, rangers have observed off-road snowmobile tracks up to 2.5 miles inside Yellowstone’s backcountry. Rangers regularly patrol the boundary and have the option to ticket, arrest, and confiscate the snowmobiles of the violators, who can expect to face aggressive prosecution (NPS 2009c).

Severe Weather Conditions

According to industry standards established by the ACGIH, all non-essential work should stop at a temperature of -25° Fahrenheit (F) if there is a 20 mph wind. With no noticeable wind, the temperature at which non-essential work should cease is -45°F. Travel by snowmobile may produce wind-chill factors of -40 degrees.

Current Yellowstone employee procedures state that snowmobile travel is not advised for non-essential work at temperatures below -20°F. Non-essential work includes activities such as travel to meetings, training, and other administrative travel; avalanche control procedures; interpretive programs and roving interpretation; resource monitoring; research fieldwork, etc. Temporary park closures may be enacted as necessary to provide for the safety of the public and employees during severe weather.

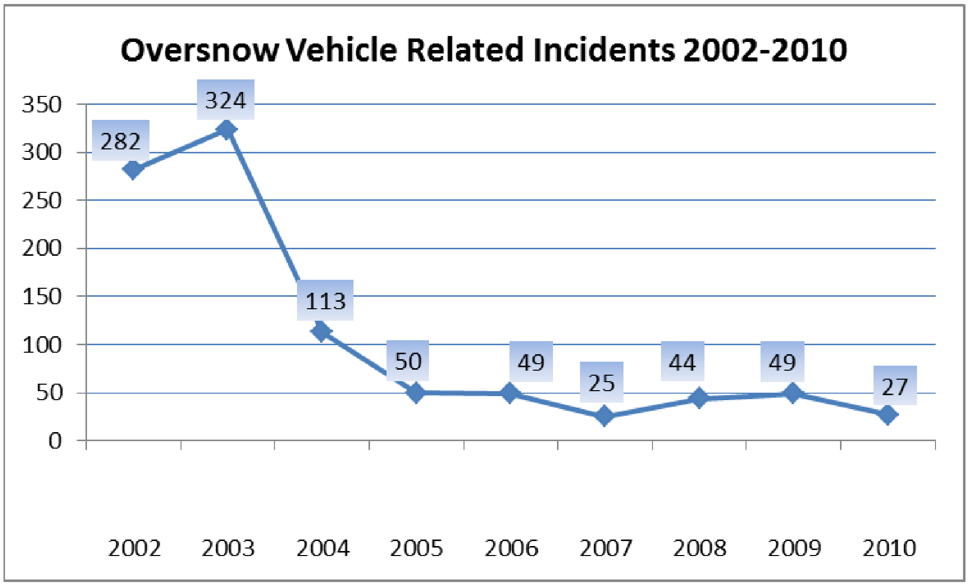


FIGURE 16: WINTER LAW ENFORCEMENT STATISTICS, 2002–2010

SOCIOECONOMIC VALUES

EXISTING AND HISTORIC SOCIOECONOMIC CONDITIONS

Economy of the Greater Yellowstone Area

The affected environment for socioeconomics of the greater Yellowstone area is described at three different levels: a state level (Idaho, Montana, and Wyoming) and a county level (Fremont County in Idaho, Gallatin and Park Counties in Montana, and Park and Teton Counties in Wyoming). The economy is discussed in further detail at a community level (Cody and Jackson, Wyoming, and West Yellowstone, Montana) where data is available. These three levels provide context for the magnitude of the impacts (both absolutely and relatively) at multiple geographic levels. These were also the levels used in analysis in the previous EIS (NPS 2000b), SEIS (NPS 2003c), EA (NPS 2004a), and EIS (NPS 2007c) for winter planning. The four communities at the local scale (Cody, Jackson, and West Yellowstone) provide a representative example of the possible effects at the city or town level. Also, these communities have been previously identified as most likely to be affected by changes in winter use policies.

Visitors also use other gateway communities or areas. For example, skiers and snowboarders at Big Sky, Montana, often spend part of their winter trip taking a snowmobile or a snowcoach tour into Yellowstone. Similarly, Livingston, Cooke City, and Gardiner, Montana, are important gateway communities to Yellowstone's north and north east entrances. Dubois, Wyoming, is a gateway community to both Yellowstone and Grand Teton. Island Park and other Idaho communities are gateways to Yellowstone. Other geographic areas, within the counties or states, but outside the communities can also be affected by the winter use alternatives. The effects on these smaller areas may be masked even at the zip code level of analysis that occurs with IMPLAN modeling, but the effects will be represented through qualitative discussions.

Table 29 presents the relative sizes of the economies of the five counties within the affected region. The range of total economic output among these areas ranges from $248 million annually in Fremont County to $3.9 billion in Gallatin County. This range suggests that a change in visitor activity that is generally small in the context of the five-county area has the potential to be substantial in the context of the smaller economy of a community like Fremont County. However, this does not mean that individuals and businesses in the area have not been affected by changes in visitor activities. Some businesses that relied specifically on snowmobile access have reported being adversely affected. Others have noted that their ability to retain highly qualified, year-round workers has been diminished (Ecosystem Research Group 2006). In a 2009 study, the NPS looked at the economic benefits to local communities from national park visitation. Using the Money Generation Model version 2 (MGM2) this study found that the nearly 3.3 million visitors in 2009 spent around $297 million year round in the local communities year-round (NPS 2009d).

TABLE 29: ECONOMIC OUTPUT AND EMPLOYMENT LEVELS FOR THE GREATER YELLOWSTONE AREA, 2008

County	Total 2008 Output in $(2011)	Total 2008 Employment
Gallatin County, MT	4,111,797,126	64,737
Park County, MT	479,283,748	8,730
Fremont County, ID	259,490,804	4,418
Park County, WY	1,300,250,448	19,448
Teton County, WY	2,417,607,915	30,458
Cody, WY	786,677,477	11,876
West Yellowstone, MT	101,281,028	1,740
Jackson, WY	1,854,443,978	22,565
Five-County Area Total	8,568,430,041	127,791
3-State Area Total	130,462,241,081	1,942,947

Source: IMPLAN (2008).

Table 30 illustrates breakdown of employment by industry for the five-county affected region. The four largest industries are government and government enterprises; accommodation and food services; construction; and retail trade (BEA 2010).

TABLE 30: EMPLOYMENT BY MAJOR INDUSTRY AND GEOGRAPHIC REGION, 2008

Industry	Five-County Area (Employees)	% of total Employees
Farm employment	3,512	2.6%
Forestry, fishing, and related activities	1,138	0.8%
Mining	1,550	1.2%
Utilities	238	0.2%
Construction	15,243	11.4%
Manufacturing	4,518	3.4%
Wholesale trade	2,176	1.6%
Retail trade	15,150	11.3%
Transportation and warehousing	2,740	2.0%
Information	1,748	1.3%
Finance and insurance	5,005	3.7%
Real estate and rental and leasing	10,354	7.7%
Professional, scientific, and technical services	9,701	7.2%
Management of companies and enterprises	183	0.1%
Administrative and waste services	4,519	3.4%
Educational services	1,725	1.3%
Health care and social assistance	8,236	6.1%
Arts, entertainment, and recreation	5,189	3.9%
Accommodation and food services	16,704	12.5%
Other services, except public administration	6,976	5.2%
Government and government enterprises	17,557	13.1%
Total	134,162	100%

Source: BEA 2010.

Looking specifically at the travel industry, Taylor, Foulke, and Coupal (2008) presented information for the three Wyoming counties that contain most of the Shoshone National Forest (table 31). Park County had the highest earnings between 1997 and 2006. Taylor et al. also present information in their report on the counties surrounding BTNF. After adjusting for inflation, total visitor spending in Fremont, Lincoln, Sublette, and Teton counties in Wyoming (the counties surrounding BTNF) increased from $467.4 million in 1997 to $605.4 million in 2005 (+29.5%) (Taylor et al. 2008).

TABLE 31: TRAVEL INDUSTRY EARNINGS FOR SHOSHONE NATIONAL FOREST AREA (FREMONT, HOT SPRINGS, AND PARK COUNTIES), 1997–2006

Year	Deflated Fremont	Deflated Hot Springs	Deflated Park	Deflated 3-County Area
1997	$22,009,349	$4,506,676	$44,018,697	$70,534,722
2001	$24,316,644	$4,882,860	$49,023,916	$78,223,420
2002	$24,475,222	$4,703,082	$51,062,033	$80,240,337
2003	$24,905,079	$4,793,053	$52,441,638	$82,139,769
2004	$26,867,472	$4,752,070	$52,638,313	$84,257,855
2005	$27,433,628	$5,221,239	$53,274,336	$85,929,204
2006	$28,481,474	$6,262,493	$49,928,367	$84,672,334
Total Change 1997 to 2006	29.4%	39.0%	13.4%	20.0%
Annual Change 1997 to 2006	2.9%	3.7%	1.4%	2.0%

Source: Dean Runyan Associates (in 2000$), from Taylor, Foulke, and Coupal 2008.

RECENT TRENDS IN PARK VISITATION

Previous estimates of changes in greater Yellowstone area visitation in response to changes in winter use policies relied primarily on visitor surveys to predict future policy impacts (Duffield and Neher 2000; RTI International 2004). The current analysis, however, benefits from several years of data collected during periods of varying winter use visitation levels. These sources of observed data allow the current analysis to incorporate trends in winter economic activity to supplement predictions based on visitor survey responses. Visitation data for the park is presented in the "Visitor Access and Circulation" section in this chapter.

RECENT TRENDS IN THE GREATER YELLOWSTONE AREA ECONOMY

Analyses for previous winter use planning efforts in the park has predicted that restrictions on some types of winter use (primarily snowmobiles) would be at least partially offset by winter visitors still recreating in the greater Yellowstone area but using other recreational opportunities outside of the park. As a general example, it was predicted that restricting access to the park for some uses, such as snowmobiling, could lead to offsetting increases in use of other greater Yellowstone area recreational opportunities, such as snowmobiling in the national forests; however, there have been declines in both snowmobile visits and total winter visitation to Yellowstone in the past six years. An examination of key tourism-targeted tax collections in the greater Yellowstone area counties bordering the park provides information on the degree to which the economies of these counties and communities are economically dependent on park winter visitation.[1]

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[1] All the tax information reported in the tables and figures are as reported by the respective states and do not include an inflation factor. Lodging costs typically increase as a result of inflation; thus, lodging tax revenue (which is a percentage of the cost of lodging) will also increase. When inflation is included, the inflation-adjusted tax revenue may be lower, even though the tax dollars stay the same or increase (Taylor 2007). The NPS chooses to present lodging tax information without an inflation adjustment since there are a variety of possible indices, but notes through the reference to Taylor 2007 that such adjustments can be made. Also, another similar report examining tourism in Wyoming (Dean Runyan Associates 2006) and cited by Taylor 2007 does not (except for one table in a 71-page report) take inflation into account.

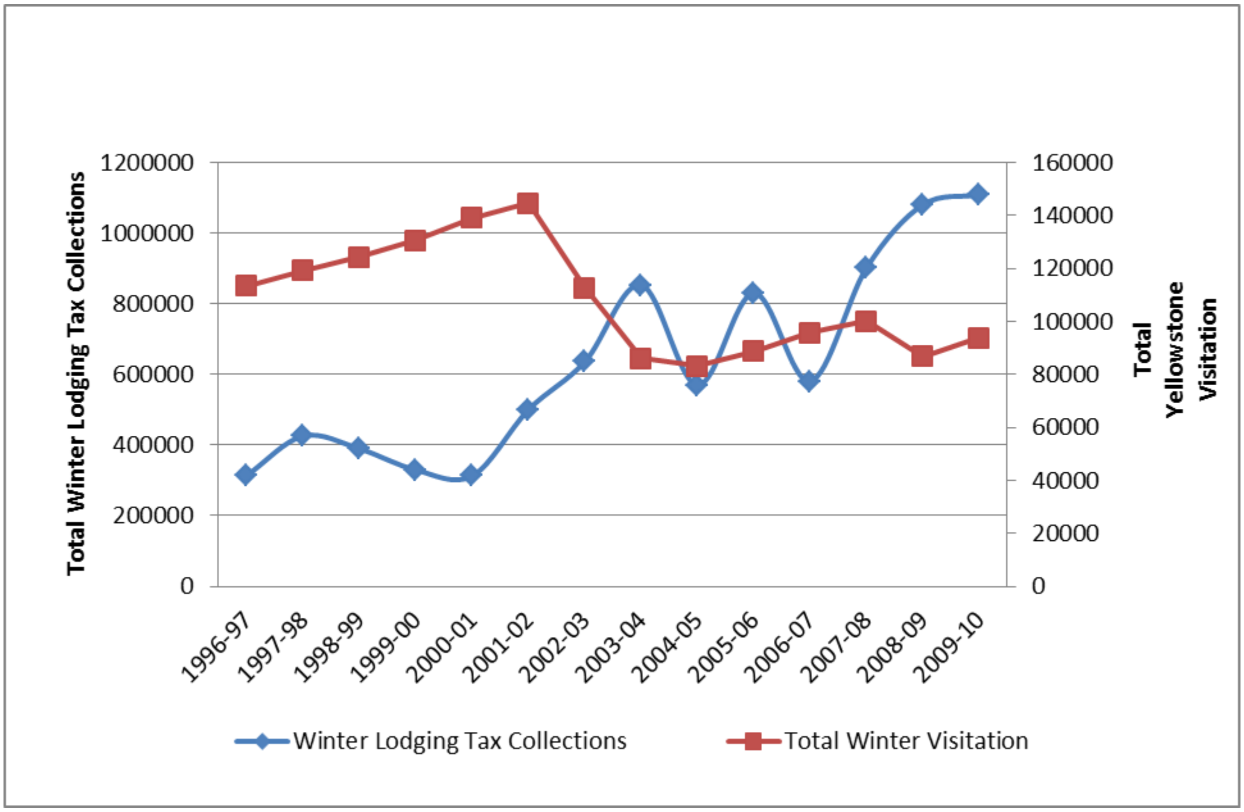
Table 32 and figure 17 present winter lodging collections for Fremont County, Idaho. In general, during the period of time when winter visitation to Yellowstone was decreasing (2002/2003 through 2005/2006), winter lodging tax collections in Fremont County trended upwards—the opposite of Yellowstone visitation trends. Fremont County winter lodging tax collections in 2005-2006 were over double the level seen in the four years prior to 2002 (and the management changes that began in 2003). Winter lodging taxes in Fremont County seem to more closely match the statewide 16.7% growth in lodging tax that occurred during the same period (Otter 2007). From 2006 to 2010, winter park visitation has remained relatively stagnant, whereas winter lodging tax collections have increased by more than 90%. Park County, Wyoming, on the east side of Yellowstone has similar winter lodging tax information during this same time period (see table 33 and figure 18).

TABLE 32: FREMONT COUNTY, IDAHO, WINTER LODGING TAX COLLECTIONS COMPARED WITH YELLOWSTONE NATIONAL PARK WINTER VISITATION, 1996/1997 THROUGH 2009/2010

Winter Season	Dec	Jan	Feb	Mar	Winter Fremont County Lodging Tax Collections	Total Yellowstone Winter Visitation
1996/1997	$42,441	$44,183	$83,866	$143,806	$314,296	113,504
1997/1998	$204,652	$34,754	$114,365	$71,945	$425,716	119,271
1998/1999	$93,591	$55,816	$180,620	$59,299	$389,326	124,275
1999/2000	$76,263	$70,473	$112,822	$69,865	$329,423	130,563
2000/2001	$80,688	$58,952	$101,676	$71,411	$312,727	139,122
2001/2002	$123,261	$76,855	$144,869	$155,416	$500,401	144,490
2002/2003	$61,374	$131,383	$239,068	$204,393	$636,218	112,741
2003/2004	$246,769	$107,345	$406,135	$92,864	$853,113	86,107
2004/2005	$116,323	$4,661	$335,441	$112,605	$569,030	83,235
2005/2006	$221,627	$261,024	$236,964	$111,201	$830,816	88,718
2006/2007	$56,010	$274,561	$101,271	$148,902	$580,744	95,675
2007/2008	$101,340	$366,934	$169,966	$263,416	$901,656	99,975
2008/2009	$199,351	$586,581	$23,043	$271,072	$1,080,047	86,784
2009/2010	$200,363	$185,892	$196,378	$525,717	$1,108,350	93,838

Note: Not adjusted for inflation.

Source: Idaho State Tax Commission (2010).



Note: Lodging collections not adjusted for inflation.

Source: Idaho State Tax Commission (2010).

FIGURE 17: COMPARISON OF FREMONT COUNTY, IDAHO, WINTER LODGING COLLECTIONS AND YELLOWSTONE NATIONAL PARK WINTER RECREATIONAL VISITATION, 1996/1997 THROUGH 2009/2010

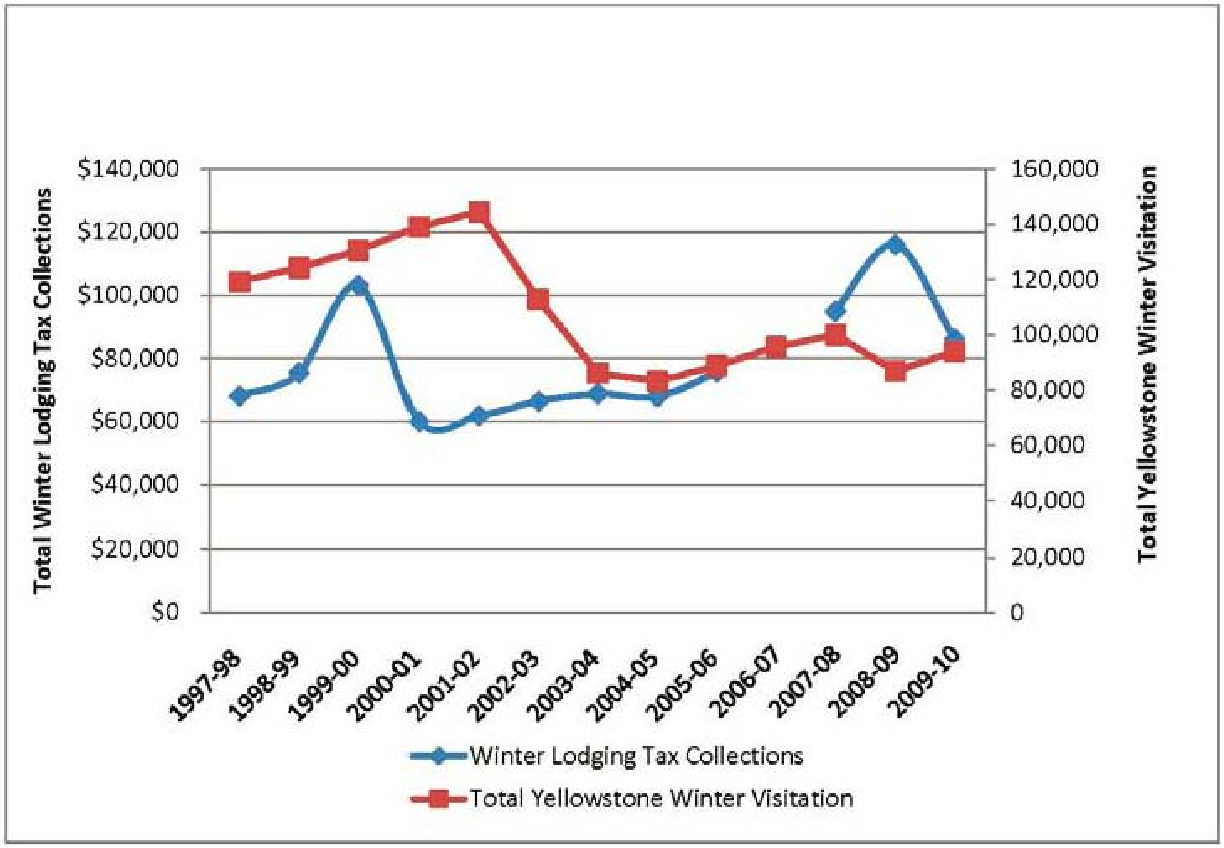
TABLE 33: PARK COUNTY, WYOMING, WINTER LODGING TAX COLLECTIONS, IN TAX YEAR DOLLARS, COMPARED WITH YELLOWSTONE NATIONAL PARK OVERSNOW VISITATION, 1997/1998 THROUGH 2009/2010*

Winter Season	Dec	Jan	Feb	Mar	Winter Lodging Tax Collections	Total Yellowstone Winter Visitation
1997/1998	$33,155	$8,498	$13,458	$12,965	$68,075	119,271
1998/1999	$24,258	$9,523	$12,509	$29,218	$75,509	124,275
1999/2000	$59,379	$14,971	$10,617	$18,184	$103,151	130,563
2000/2001	$20,467	$9,384	$16,200	$13,955	$60,006	139,122
2001/2002	$26,971	$9,477	$12,352	$13,072	$61,872	144,490
2002/2003	$27,486	$14,217	$10,417	$14,256	$66,376	112,741
2003/2004	$28,765	$12,527	$9,455	$18,090	$68,837	86,107
2004/2005	$27,841	$13,210	$13,313	$13,556	$67,919	83,235
2005/2006	$20,520	$21,382	$20,532	$13,244	$75,679	88,718
2006/2007	(data not available)					95,675
2007/2008	$28,909	$14,111	$25,512	$26,425	$94.957	99,975
2008/2009	$46,397	$18,128	$29,360	$22,199	$116,084	86,784
2009/2010	$31,478	$16,577	$13,463	$24,625	$86,143	93,838

Note: Not adjusted for inflation

*The report, “Economic Trends in the Winter Season for Park County, Wyoming” by David T. Taylor (2007) presents different winter lodging tax information (excluding December and lagged 2-months) for 5 of the 9 years presented above(from 1997 to 2006). However, the general lodging tax trends (without regard to inflation) are the same in both reports. Additionally, 2007/2008 tax collection data were not available.

Source: Wyoming Department of Revenue 2010.



Note: Data for 2007-08 are not available. Lodging tax collections not adjusted for inflation.

Source: Wyoming Department of Revenue 2010.

FIGURE 18: COMPARISON OF PARK COUNTY, WYOMING, WINTER LODGING TAX COLLECTIONS, AND YELLOWSTONE NATIONAL PARK OVERSNOW VISITATION, 1997/1998 THROUGH 2009/2010

The main community in Park County is Cody. In addition, Park County encompasses the northern portion of Yellowstone, including the Mammoth Hot Springs Hotel, which is open during the winter (Snow Lodge, at Old Faithful, is in Teton County, Wyoming). This table shows both total OSV visitation levels for Yellowstone and total winter lodging tax collections for the county. As is the case in Fremont County, winter lodging tax collections did not follow the decrease in Yellowstone OSV visitation between 2002 and 2006. The Mammoth Hot Springs Hotel accounts for 41% of the Park County lodging tax in the winter.

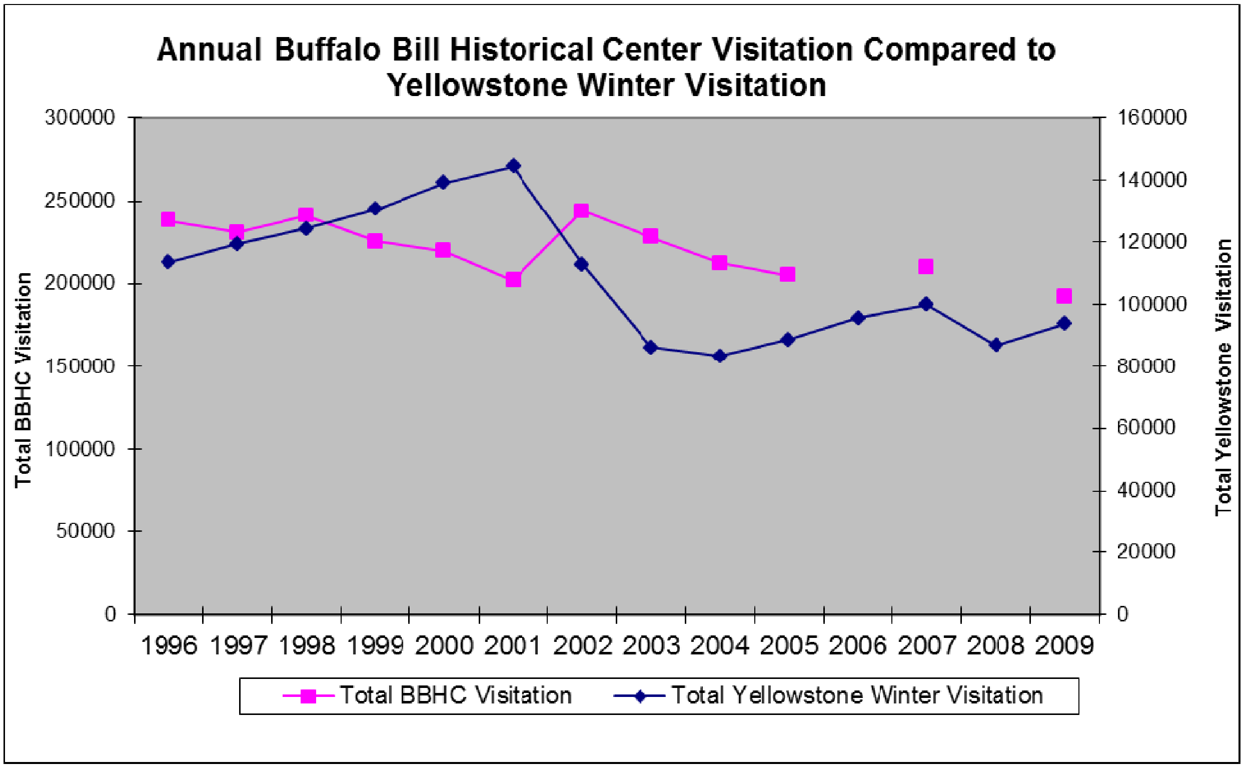
Table 34, from Taylor, Foulke, and Coupal (2008), shows local tax revenue collections for the entire year, adjusted for inflation, for Fremont, Hot Springs and Park Counties. Between 1997 and 2006, tax revenues increased in a similar manner to the winter lodgings tax revenue displayed in table 34. Park County has higher travel-related tax revenue than Fremont and Hot Springs. The report by Taylor et al. (2008) also presented information on local tax receipts for the counties surrounding BTNF (Fremont, Lincoln, Sublette, and Teton counties in Wyoming). Local tax receipts from travel spending, adjusted for inflation, increased from $9.5 million in 1997 to $11.3 million in 2005 (+19.0%, and a compound average growth rate of 2.2 percent per year).

TABLE 34: TRAVEL INDUSTRY LOCAL TAX REVENUE FOR SHOSHONE NATIONAL FOREST AREA (FREMONT, HOT SPRINGS AND PARK COUNTIES), 1997–2006

Year	Deflated			
	Fremont	Hot Springs	Park	3-County Area
1997	$524,032	$209,613	$1,781,709	$2,515,354
2001	$585,943	$292,972	$2,050,801	$2,929,716
2002	$671,869	$287,944	$2,207,569	$3,167,382
2003	$657,870	$281,944	$2,255,554	$3,195,369
2004	$639,702	$274,158	$2,193,263	$3,107,123
2005	$707,965	$353,982	$2,389,381	$3,451,327
2006	$772,088	$428,938	$2,316,264	$3,517,290
Total Change 1997 to 2006	47.3%	104.6%	30.0%	39.8%
Annual Change 1997 to 2006	4.4%	8.3%	3.0%	3.8%

Source: Dean Runyan Associates (in 2000 dollars), from Taylor, Foulke, and Coupal (2008).

Recent lodging and tax data for Fremont and Park counties indicate that declines in snowmobile entries into Yellowstone in particular, and in winter visitation in the park in general, have not detectably impacted the overall winter tourist economy in the counties as measured by monthly lodging tax collections. This is despite the fact that the economies of these counties are relatively small. Visitation to Yellowstone can also be compared to other local attractions. The Buffalo Bill Historical Center (BBHC) is in Cody, Wyoming. Figure 19 indicates that overall Yellowstone winter visitation and BBHC winter visitation seem to move together.



Source: BBHC (2010)

Note: Data on visitation to BBHC missing for 2006 and 2008.

FIGURE 19: COMPARISON OF BUFFALO BILL HISTORIC CENTER WINTER VISITATION WITH AND YELLOWSTONE NATIONAL PARK OVERALL WINTER VISITATION (WHEELED AND OVERSNOW), 1996/1997 THROUGH 2009

Two other adjoining counties, Gallatin County in Montana (including Bozeman) and Teton County in Wyoming (including Jackson) have relatively large economies where even substantial changes in Yellowstone and Grand Teton National Park winter visitation would not be detectable. For example, the observed change in visitation at the south entrance in response to the 2004 Temporary Winter Use Plan was estimated to have an expenditure impact on the order of $4 million per year. By comparison, the five-county greater Yellowstone area economy (largely driven by Gallatin and Teton counties) was on the order of $6 billion in 1999 and in 2008 (the most recent IMPLAN data available) had grown to about $8 billion. Similarly, impacts from changes in the park's winter visitation levels for the three-state economy would not be detectable.

However, the size of the economic impacts relative to the size of the county economies masks impacts on some individual businesses, which have indicated a considerable reduction in their winter operations. Other employment patterns have changed (year-round work for some employees is no longer available) as a result of changing visitation patterns (Ecosystem Research Group 2006).

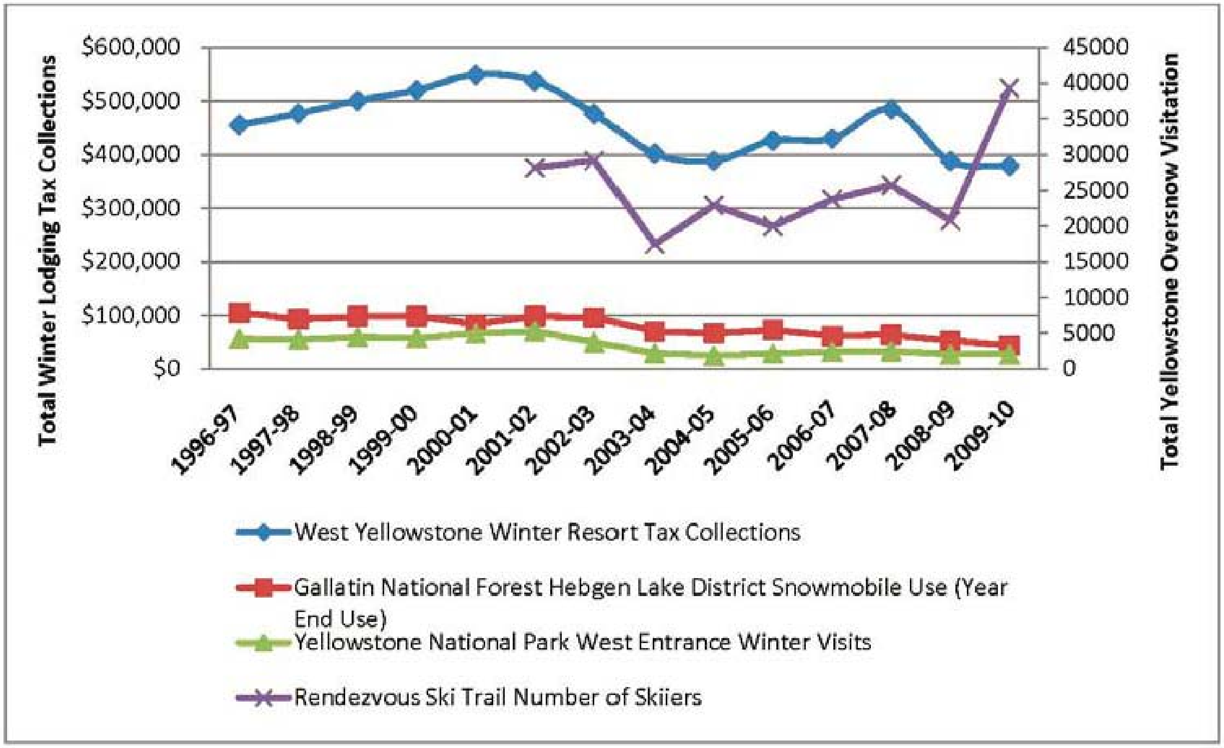
At the north entrance gateway of Gardiner, Montana (Park County), almost all winter use is wheeled vehicle entries. Neither the 2004 Temporary Winter Use Plan (NPS 2004a) nor the 2007 FEIS had a noticeable effect on visitation through this entrance. Visitors there are destined for Mammoth Hot Springs and sites such as the Lamar Valley in the park's northern range (which are both in Park County, Wyoming) or other Yellowstone locations or to recreate in and around Cooke City, Montana (which is in Park County, Montana).

Another indicator and change in the winter economy is wildlife viewing in Yellowstone. A 2004-2006 year-round survey looked at the economic effects of wolf watching and wolf presence to Yellowstone visitors. Winter visitors, who constitute about 3.1% of the annual visitation to Yellowstone, contribute about $1.3 million to the 17-county economy just related to wolf presence in Yellowstone. This is about 5.8% of the total annual $22.5 million direct spending impact of wolf watching to the 17-county economy (Duffield, Neher, and Patterson 2006).

The remaining major gateway community for Yellowstone is West Yellowstone, at the west entrance to Yellowstone. Table 35 provides time series data for this entrance, shown graphically in figure 20. Included in the table are winter resort tax collections for the town of West Yellowstone, winter entries through the west entrance to Yellowstone, and winter snowmobile visits to the Hebgen Lake District of the Gallatin National Forest, which abuts the town to the west. Unlike the cases of Park and Fremont counties discussed above, reductions in winter park visits through the west entrance and to the national forests between 2002-2003 and 2005-2006 are correlated with declines in resort tax collections. However, the decline was not in proportion to the decrease in west entrance visits. Specifically, comparing average levels for the four years immediately before and after management changes (2002/2003 through 2005/2006 to the four years immediately preceding this period) shows that although park visitation fell 48.5% on average, winter tax collections only fell 19.7%. However, Montana's statewide lodging tax rose 17% during the same time period.

TABLE 35: WEST YELLOWSTONE WINTER RESORT TAX COLLECTIONS, HEBGEN LAKE DISTRICT SNOWMOBILE USE, YELLOWSTONE WEST ENTRANCE WINTER VISITS, AND RENDEZVOUS SKI TRAIL VISITS 1996/1997 THROUGH 2009/2010

Winter Season	West Yellowstone Winter Resort Tax Collections	Gallatin National Forest Hebgen Lake District Snowmobile Use (Year End Use)	Yellowstone National Park West Entrance Winter Visits	Rendezvous Ski Trail Number of Skiers
1996/1997	$455,035	105,182	56,212	n/a
1997/1998	$476,508	93,208	54,859	n/a
1998/1999	$500,473	98,326	59,928	n/a
1999/2000	$520,566	98,838	58,154	n/a
2000/2001	$549,182	83,721	66,302	n/a
2001/2002	$536,996	98,595	70,371	28,139
2002/2003	$476,037	95,924	49,703	29,139
2003/2004	$401,664	69,996	28,880	17,461
2004/2005	$388,222	66,889	24,510	22,912
2005/2006	$425,933	73,065	28,243	19,974
2006/2007	$429,336	61,240	31,686	23,741
2007/2008	$484,278	64,019	32,942	25,714
2008/2009	$387,444	52,791	26,830	20,799
2009/2010	$378,687	44,031	26,527	39,322



Note: Sales tax receipts not adjusted for inflation.

FIGURE 20: WEST YELLOWSTONE WINTER RESORT TAX COLLECTIONS, HEBGEN LAKE DISTRICT SNOWMOBILE USE, YELLOWSTONE WEST ENTRANCE WINTER VISITS, AND RENDEZVOUS SKI TRAIL VISITS 1996/1997 THROUGH 2009/2010

The observed data for West Yellowstone resort tax collections and west entrance visits were used to estimate a linear regression model explaining tax levels as a function of west entrance visits for a time series of the December through March winter months for the 1989/1990 through 2005/2006 winters. This estimated model explains a substantial proportion (73.2%) of the variation in winter resort tax collections. The model indicates a $5.26 increase in tax collections for each west entrance visit. Because the tax rate is 3%, this implies $175.33 of taxable expenditures in West Yellowstone for each park visit. The model also implies that in 1989-1990, some other factor accounted for a substantial share of resort tax collections. This could possibly be snowmobile use on the adjacent national forest lands, as discussed below.

Table 35 and figure 20 present data for snowmobile use in the Hebgen Lake District of the Gallatin National Forest. This district includes many miles of groomed snowmobile trails that are accessible primarily from the West Yellowstone area. In the last three winters, snowmobile use in this national forest area adjacent to West Yellowstone has declined at the same time as park visits through the west entrance declined. Causation; however, is complicated by the short time series and a drought and relatively low snow pack in recent years, including the winter of 2004/2005. These data do suggest that restrictions on snowmobile access at the west entrance have not led to noticeable increased use in the adjacent national forest.

Table 35 and figure 20 indicate that even in West Yellowstone, a community located at a park entrance and with an economy heavily dependent on tourism spending, changes in park winter use management may impact local economic activity but the economy is not wholly dependent on winter park snowmobile access. Among other activities, snowmobiling in the adjacent national forests is also important for the

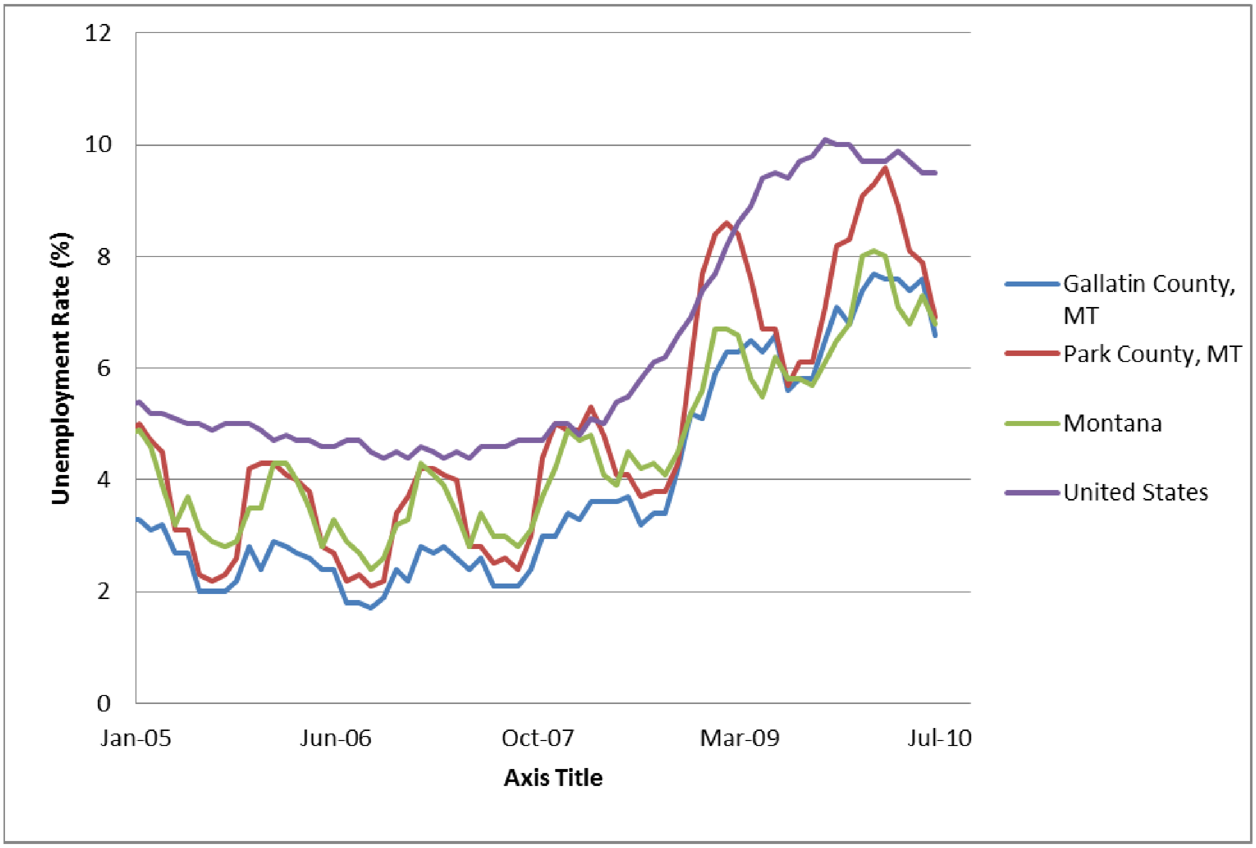
West Yellowstone economy. That hypothesis was tested by estimating a second linear regression model of winter West Yellowstone tax receipts, this time including snowmobile counts in the Hebgen Lake District as an explanatory variable in addition to Yellowstone west entrance winter visits. In this model, both park visits and forest visits are statistically important factors explaining tax receipts. Additionally, this model now accounts for most if not all of the resort tax collections. The results strongly support the hypothesis that, in addition to Yellowstone west entrance visits, snowmobiling in the adjacent national forests is also important for the West Yellowstone economy (Duffield and Neher 2006).

Of the five regional economic areas examined in this analysis, only for the gateway community of West Yellowstone is there a detectable impact on the relevant area’s economy from winter use in Yellowstone (and in the surrounding national forests). These results are consistent with the predicted impacts from the socioeconomic impacts section of the SEIS (NPS 2003d), where the authors noted that measurable impacts from changes in winter use policy in the park would only be found in the community of West Yellowstone.

It is notable that winter access by autos, recreational vehicles and buses, all of which in a normal winter would be through the north entrance, has been relatively stable. This seems to indicate that visitors are not substantially substituting access between entrances in response to changes in winter use management. Also, because access through the west, south, and east entrances to Yellowstone is all oversnow under current and historic management, there does not seem to be a shift in access modes between cars and OSVs. To conclude, the main changes with respect to visitor use levels brought about by current park management are the reduction in total snowmobile use and the partial substitution within motorized oversnow use from snowmobiles to snowcoaches. Snowmobile visitation dropped by some 60,000 and snowcoach visitors increased by approximately 10,000.

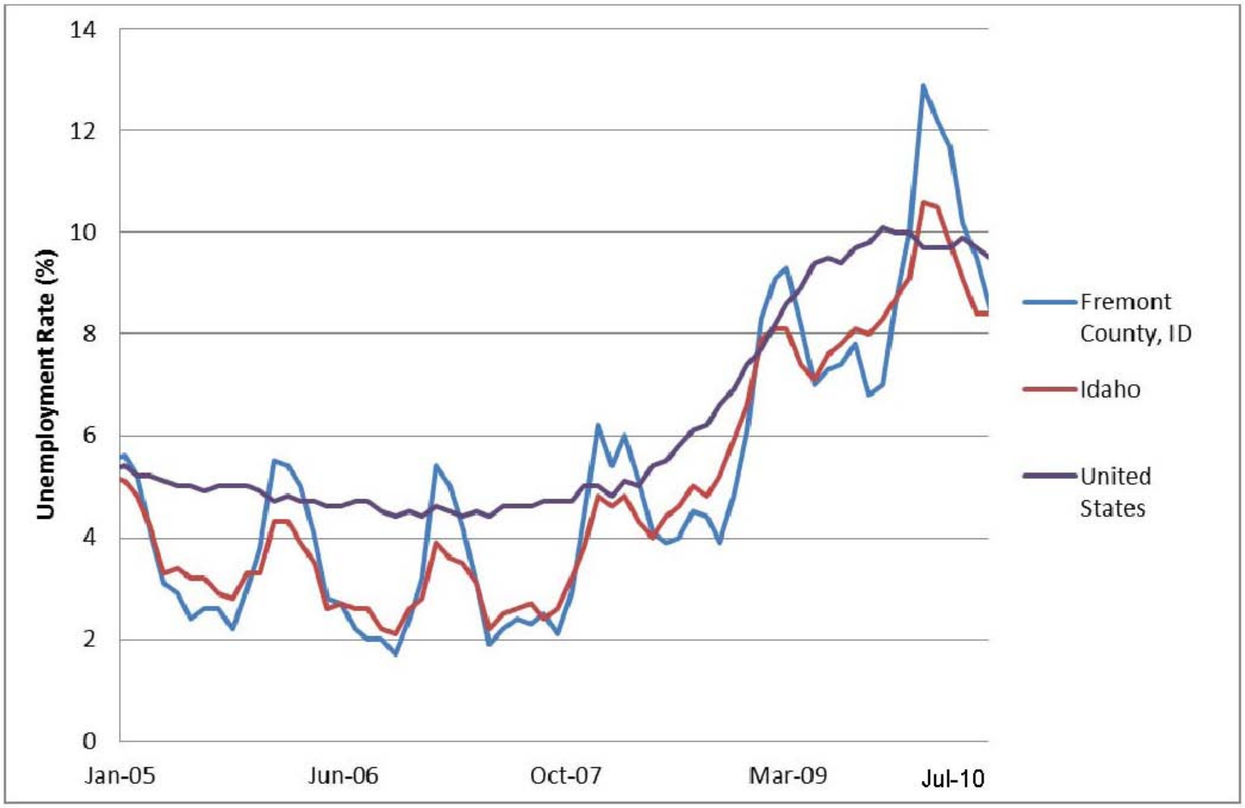
The Recent Economic Downturn

Economic conditions have worsened considerably since September 2008. The economic downturn will most likely impact visitation to the greater Yellowstone area, as well as spending by visitors who come to the area. Figures 21 to 23 compare the unemployment rates in each of the affected counties to those of their respective states as well as the United States as a whole. In Montana (figure 21), unemployment in Gallatin and Park counties has remained below that of the United States for the most part, although Park County’s unemployment rate has grown more volatile in the past two years. After a spike near the end of 2009, unemployment in Idaho’s Fremont County (figure 22) dropped back below the national average and fell in line with Idaho’s statewide rate. In Wyoming, Park County has generally mirrored the statewide unemployment rate whereas Teton County has exhibited much more exaggerated highs and lows from late 2008 into early 2010 (figure 23). As of July 2010, all counties in the affected area had unemployment rates below the national average.



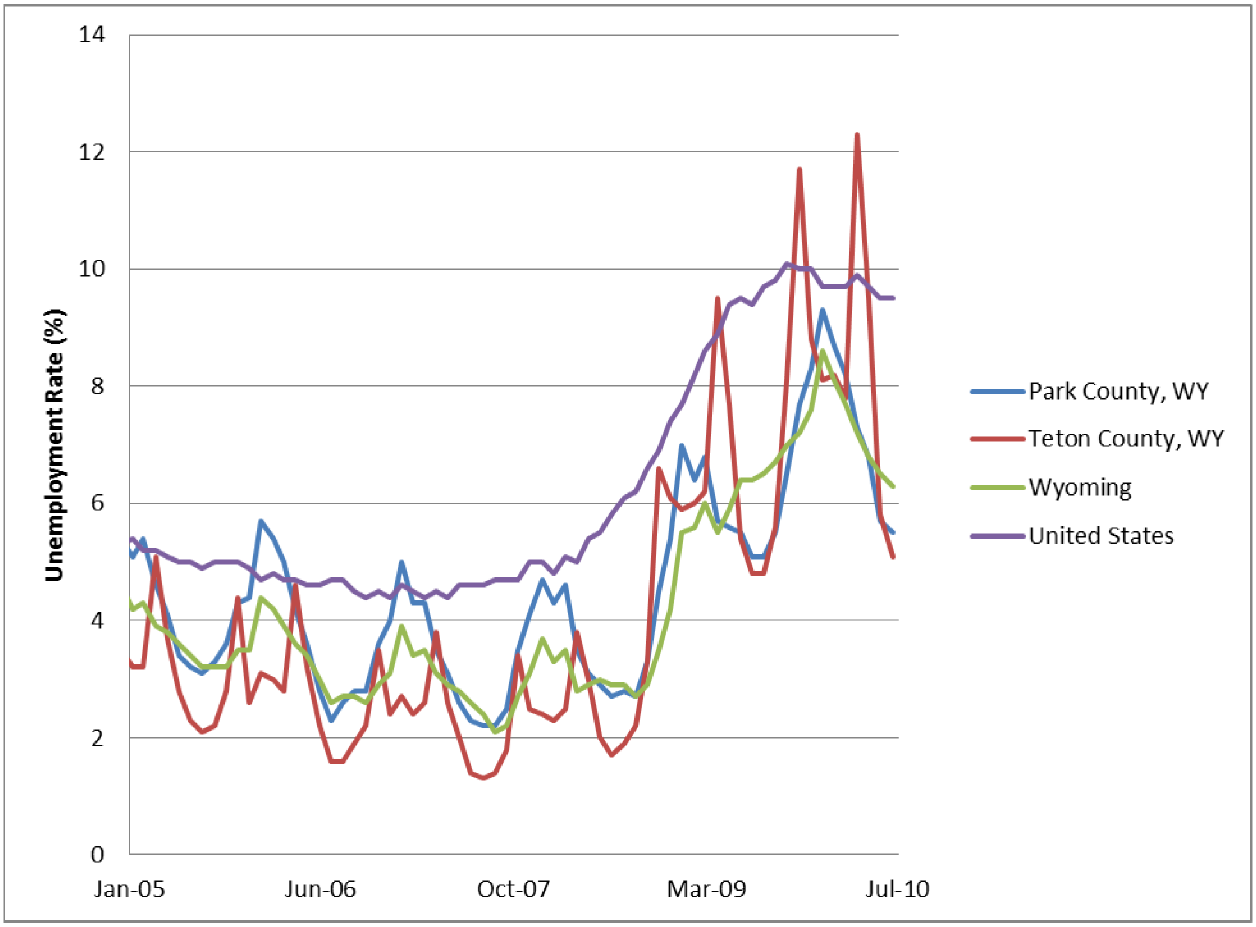
Source: Bureau of Labor Statistics 2010. Series LAUCN30031003, LAUCN30067003, LAUST30000003, LNS14000000.

FIGURE 21: UNEMPLOYMENT RATES IN GALLATIN COUNTY, PARK COUNTY, MONTANA, AND THE UNITED STATES, JANUARY 2005-JULY 2010



Source: Bureau of Labor Statistics, 2010. Series LAUCN16043003, LAUST16000003, LNS14000000.

FIGURE 22: UNEMPLOYMENT RATES IN FREMONT COUNTY, IDAHO, AND THE UNITED STATES, JANUARY 2005-JULY 2010



Source: Bureau of Labor Statistics, 2010. Series LAUCN56029003, LAUCN56039003, LAUST56000003, LNS14000000.

FIGURE 23: UNEMPLOYMENT RATES IN PARK COUNTY, TETON COUNTY, WYOMING, AND THE UNITED STATES, JANUARY 2005-JULY 2010

PARK OPERATIONS AND MANAGEMENT

The NPS, park concessioners, contractors, researchers, and other duly permitted parties depend on snowmobiles and snowcoaches for their administrative functions. These uses of the park are not within the purpose and need, but are within the scope of analysis in this draft plan/EIS because as shown in the analysis for some impact topics, such as soundscapes, winter operations have an effect.

NPS EMPLOYEES AND CONCESSIONS

Approximately 82 permanent and seasonal NPS employees, including those at the West Entrance, plus their family members overwinter in the interior of Yellowstone. Additionally, Xanterra Parks & Resorts stations approximately 150 employees in the interior during the winter season, almost exclusively at Old Faithful (Regula pers. comm., 2010). These NPS and Xanterra employees not only provide critical law enforcement, interpretive, and guest services to winter visitors, but they also maintain and protect Yellowstone's natural and cultural resources. For example, some employees clear accumulating snow from the park's wide array of historic buildings, including National Historic Landmarks such as the Old Faithful Inn and the Fishing Bridge, Madison, and Norris museums.

The employees living in the park's interior occupy a unique environment, for they have no wheeled vehicle access to their homes. Their only access to groceries, supplies, and medical care is by OSVs. Almost nowhere else in the United States, outside Alaska, are whole communities of people living and working in an oversnow environment such as the interior of Yellowstone. Due to their unique situation, using snowmobiles for both work-related and personal use is clearly appropriate under executive orders and policy.

Other NPS and concessions employees, as well as permitted researchers and authorized contractors, conduct similar work and personal activities by OSV. Park guides and outfitters are also authorized to use snowmobiles and snowcoaches in the park for administrative access to repair or tow disabled vehicles. These and other administrative uses are necessary for the park to carry out its mission in accordance with the NPS Organic Act, and are focused on ensuring the health and safety of visitors and park residents, providing for public enjoyment of the park, and protecting park resources.

Most permanent interior NPS employees must own a snowmobile as a precondition of employment, but interior-based concessions employees do not have such a requirement. Guests of any employees are encouraged to use BAT OSVs when authorized to enter the park. Permitted researchers are encouraged to use BAT vehicles as a condition of their permit. Any newly issued contracts that require a contractor to travel via OSV to conduct their work in the park (for example, a construction project) include a BAT requirement. Older contracts did not include this requirement.

The majority of the NPS administrative OSV fleet in Yellowstone is now BAT. For the 2009/2010 season, Yellowstone had 126 snowmobiles (both leased and owned) in its administrative fleet, of which 93% met BAT requirements. All non-BAT vehicles (9 in total) are needed for specialized use, such as law enforcement (boundary patrol, search and rescue) and other administrative purposes on a limited basis where the heavier weight and lower horsepower of current BAT machines do not perform adequately. Other administratively authorized snowmobiles, such as employee-owned snowmobiles, are encouraged to meet BAT requirements.

In addition to administrative snowmobiles, Yellowstone operates 14 other OSVs. These include groomers, two OSVs on loan from the state of Wyoming, ambulances, fire trucks, vans, and trucks, which are seasonally tracked and converted to OSV use.

The NPS has been shifting to a leased snowmobile fleet, rather than purchasing snowmobiles, to save on maintenance costs. An average of 1,700 miles is put on each snowmobile per winter. The park uses about 23,000 gallons of bio-diesel (primarily for grooming equipment) and about 14,000 gallons of ethanol blend gasoline per winter in its oversnow fleet (average of the winters 2002/2003 through 2005/2006).

The NPS transports goods and materials to support winter operations via some of these OSVs. Although all fuel and larger goods are transported to interior locations by wheeled vehicle before the start of the winter season, during the course of the winter, additional supplies are conveyed via OSV to support park personnel accomplishing their work in the winter. Other OSV uses include resource monitoring, personal use, and concession support such as laundry and luggage service.

COST OF WINTER USE MANAGEMENT

Under the 2009 interim rule (winter seasons 2009/2010 and 2010/2011), winter operations cost the park approximately $3,967,350. This includes the cost of grooming snow roads, plowing operations for spring opening, plowing the west side roads, and removal in the spring, leasing and maintenance of parks OSVs (snowmobiles and tracked vehicles), Sylvan Pass management, operation of the sand shed and warming huts, and the employees needed during this time.

Park staff in the winter season includes 82 employees duty stationed in interior locations, including the West Entrance. Winter operations also include the operation of 126 snowmobiles and 14 tracked vehicles. The cost of winter operations is shown in table 36.

TABLE 36: UNIT COSTS FOR WINTER USE MANAGEMENT

Units	Cost
Grooming snow roads: (grooming 180 miles every third day)	$314,640 per season; $46 per mile per day
Spring opening: (average of past three years; 199 miles of mainline road are plowed in park)	$789,000 per year; $3,965 per mile
Plowing West Side Roads (approximately 65 miles and parking areas; plowing every day)	$457,240 per winter
Sand removal in spring	$120/mile
Snowmobile fleet lease and maintenance (currently 126 snowmobiles)	$317,030; $2,516 per snowmobile
Tracked vehicle maintenance (currently 14 tracked vehicles)	$5,000 per vehicle per year
Sylvan Pass avalanche management	$325,000 per season
Sand Shed (sand and vehicle storage-plowing)	$450,000 per building
Warming Hut	$200,000 per building
Employee cost per year (average salary and benefits) (currently 82 staff are duty stationed in the interior of the park in the winter)	$78,720 / FTE

CHAPTER 4

Environmental Consequences

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

The "Environmental Consequences" chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternative elements described in this Draft Winter Use Plan and Environmental Impact Statement (plan/EIS). In addition, this chapter includes a summary of laws and policies relevant to each impact topic, intensity definitions (negligible, minor, moderate, and major) and methods used to analyze impacts including direct, indirect, and cumulative impacts. As required by the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA), a summary of the environmental consequences for each alternative is provided in table 12, which can be found in "Chapter 2: Alternatives." The resource topics presented in this chapter, and the organization of these topics, correspond to the resource discussions contained in "Chapter 3: Affected Environment."

For a complete discussion guiding authorities, refer to the section titled "Related Laws, Policies, Plans, and Constraints" in "Chapter 1: Purpose of and Need for Action."

In addition to the related laws, plans and constraints discussed in chapter 1, section 4.5 of the Director's Order 12 Handbook adds to this guidance by stating, "when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the National Park Service (NPS) will follow the provisions of the CEQ regulations (40 CFR 1502.22)." In summary, the NPS must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and; (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community. Collectively, these guiding laws and corresponding regulations provide a framework and process for evaluating the impacts of the alternatives considered in this draft plan/EIS.

GENERAL ASSUMPTIONS

Several guiding assumptions were made to provide context for this analysis. These assumptions are described below.

ANALYSIS PERIOD

This draft plan/EIS establishes objectives and specific management actions needed to manage winter use in Yellowstone National Park (Yellowstone or the park) for approximately the next 20 years; therefore, the analysis period used for assessing impacts is 20 years into the future. The impact analysis for each alternative is based on the principles of adaptive management, which would allow the NPS to change management actions over time as new information emerges through monitoring the results of management actions, ongoing research, or the development of new technology. When referring to the level of oversnow vehicle (OSV) use in the park, the timeline (table 37) has been broken into historic use levels (pre-2004), recent use (2004-2009), and the latest winter season for which the park has data (2009/2010 winter season). Because the level of winter use permitted has varied over the years, the analysis of the alternatives discusses various levels of use when referring to past use levels. Table 37 provides the use levels, average and peak, for OSV during these periods.

TABLE 37: OSV USE LEVELS REFERRED TO IN THE ANALYSIS

	Snowmobiles	Snowcoaches
Historic (pre-2004) Average	765	15
Historic (pre-2004) Peak	1457	35
Recent Use (2004-2009) Average	258	30
Recent Use (2004-2009) Peak Average	488 *	55*
Last season 2009/2010 Average	187	32
Last season 2009/2010 Peak	293	59
Use Limits by Alternative		
Alternative 1	0	0
Alternative 2	318**	78
Alternative 3	720	78
Alternative 4	110	30
Alternative 5	318 until 2004/2005+	78 until 2004/2005+
Alternative 6	Daily entry between 0 and 540, 32,000 per winter season	Daily entry between 0 and 78, 4,600 per winter season
Alternative 7	330 for ½ winter season, 220 1/3 for winter season, 132 for 1/6 winter season	80 for ½ winter season, 50 for 1/3 winter season, 30 for 1/6 winter season

Historic average and peak (1992-2000) was from the 2000 EIS page G-3 (NPS 200b).

*Actual Peak day was 557 snowmobiles and 60 snowcoaches both in 2007/2008. The numbers 488 and 55 represent averages of the five highest snowmobile and snowcoach days.

** Actual current average is about 187 snowmobiles per day.

+ After 2004/2005 season, use may be between 78 to 120 snowcoaches and 0 to 318 snowmobiles depending on demand.

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The general geographic study area for this draft plan/EIS is Yellowstone National Park in its entirety. However, the area of analysis may vary by impact topic beyond the boundaries of the park as applicable.

TYPE OF IMPACTS

The following general assumptions are used for all impact topics. Where the duration varies for an impact topic, it has been noted in the section "Assumptions, Methodology, and Intensity Definitions."

- Short term: Impacts would be temporary (i.e., they would occur for a matter of hours up to weeks at a time), and would generally last no longer than one season, without lasting effects.
- Long term: Impacts would be continuous throughout the life of the plan potentially occurring every winter, with potentially permanent effects.
- Direct: Impacts would occur as a direct result of winter use management actions.

- Indirect: Impacts would occur from winter use management actions but would occur later in time or farther removed in distance.
- Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
- Adverse: A negative change to the appearance or condition of the resource.

INTENSITY DEFINITIONS

The terms “impact” and “effect” are used interchangeably throughout this document. The impacts are qualitatively and quantitatively assessed using definitions that provide the reader with an idea of the intensity of a given impact on a specific topic. The intensity definition is determined primarily by comparing the effect to a relevant standard based on applicable or relevant/appropriate regulations or guidance, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. Except for the threatened and endangered species topic, the intensity definitions are provided for adverse impacts, and beneficial impacts are addressed qualitatively.

FORMAT OF THE ANALYSIS

For each impact topic, the assumptions, methodology, and intensity definitions (described above) for that topic are presented first to provide context for how the resource topic was evaluated. This framework for analysis is followed by a summary of impacts that provides an overview of the analysis that was preformed. The summary is then followed by the detailed impact analysis for each alternative.

CUMULATIVE IMPACTS

The CEQ regulations that implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at the park and, if applicable, the surrounding region. Past actions are those that have been occurring since winter use planning efforts began in 1990 and reasonably foreseeable future projects are those that would occur within the life of the plan.

Table 38 summarizes the actions that could affect the various resources at the park. These actions are described in more detail in the “Related Policies, Laws, Plans, and Actions” section of this document (see “Chapter 1: Purpose of and Need for Action”).

TABLE 38: CUMULATIVE IMPACT SCENARIO

Impact Topic	Study Area	Past Actions	Present Actions	Reasonably Foreseeable Future Actions
Wildlife and Wildlife Habitat, including Rare, Unique, Threatened, or Endangered Species, and Species of Concern	Park boundary, plus adjacent land	Reconstruction of east entrance road (completed 2010) Construction of west entrance road (completed 2008) Development (2000) and implementation of the Interagency Bison Management Plan (IBMP). Development and implementation of the Northern Rockies Lynx Management Direction FEIS and Amendments (2007) Development and implementation of the Gallatin National Forest Travel Plan revision (2006) Timber harvest on national forest lands Consolidation of checkerboard lands in the Gallatin National Forest Development and implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Reclamation of historic mines above Cooke City. Active population management of bison and elk herds by NPS. Reintroductions of gray wolves to the Greater Yellowstone Area	Operation of new facilities at the west entrance Implementation of the IBMP. Implementation of the Northern Rockies Lynx Management Direction FEIS and Amendments (2007) Implementation of the Gallatin National Forest Travel Plan revision (2006) Timber harvest on national forest lands Consolidation of checkerboard lands in the Gallatin National Forest Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Gardiner Basin and Cutler Meadows restoration (currently in progress) Reclamation of McClaren Mine tailings (currently in progress) (MTDEQ 2010b) Development of the EIS for remote vaccine delivery for bison	Operation of new facilities at the west entrance Implementation of the IBMP. Implementation of the Northern Rockies Lynx Management Direction FEIS and Amendments (2007) Implementation of the Gallatin National Forest Travel Plan revision (2006) Timber harvest on national forest lands Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Remote vaccine delivery EIS for bison

Impact Topic	Study Area	Past Actions	Present Actions	Reasonably Foreseeable Future Actions
Air Quality	Park boundary, plus adjacent land	Reconstruction of east entrance road (completed 2010) Development and implementation of the Gallatin National Forest Travel Plan revision (2006) Consolidation of checkerboard lands in the Gallatin National Forest. Development and implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Oil and gas leasing	Implementation of the Gallatin National Forest Travel Plan revision (2006) Consolidation of checkerboard lands in the Gallatin National Forest Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Oil and gas leasing	Implementation of the Gallatin National Forest Travel Plan revision (2006) Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Oil and gas leasing
Soundscapes and the Acoustic Environment	Park boundary	Reconstruction of east entrance road (completed 2010) Development and implementation of the Gallatin National Forest Travel Plan revision (2006) Development and implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Consolidation of checkerboard lands in the Gallatin National Forest. Overflights	Implementation of the Gallatin National Forest Travel Plan revision (2006) Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Consolidation of checkerboard lands in the Gallatin National Forest Overflights	Implementation of the Gallatin National Forest Travel Plan revision (2006) Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Overflights
Visitor Use and Experience	Park boundary, plus adjacent land	Construction of new west entrance (completed 2008) Reconstruction of east entrance road (completed 2010)	Operation of new facilities at the west entrance Other winter use (outside of OSV use) activities occurring in the park	Operation of new facilities at the west entrance Other winter use (outside of OSV use) activities occurring in the park
Health and Safety	Park boundary	Construction of new west entrance (completed 2008) Reconstruction of east entrance road (completed 2010) Consolidation of checkerboard lands in the Gallatin National Forest	Operation of new facilities at the west entrance Consolidation of checkerboard lands on the Gallatin National Forest	Operation of new facilities at the west entrance

Impact Topic	Study Area	Past Actions	Present Actions	Reasonably Foreseeable Future Actions
Socioeconomic Values	Park boundary	Construction of new west entrance (completed 2008) Reconstruction of east entrance road (completed 2010) Development and implementation of the Gallatin National Forest Travel Plan revision (2006) Development and implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Consolidation of checkerboard lands in the Gallatin National Forest. Timber harvest on national forest lands Oil and gas leasing Reopening of the Sleeping Giant Ski Area near Yellowstone's east entrance (reopened in 2009)	Operation of new facilities at the west entrance Implementation of the Gallatin National Forest Travel Plan revision (2006) Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Consolidation of checkerboard lands in the Gallatin National Forest Operation of the Sleeping Giant Ski Area	Operation of new facilities at the west entrance Implementation of the Gallatin National Forest Travel Plan revision (2006) Implementation of the Beartooth District of Custer National Forest Travel Management Plan (2008) Operation of the Sleeping Giant Ski Area Rendezvous Ski Trail development plan
Park Operations and Management	Park boundary	Construction of new west entrance (completed 2008) Reconstruction of east entrance road (completed 2010)	Operation of new facilities at the west entrance	Operation of new facilities at the west entrance

The analysis of cumulative impacts was accomplished using four steps:

Step 1 — Identify Resources Affected

Fully identify resources affected by any of the alternatives. These include the resources addressed as impact topics in chapters 3 and 4 of this document.

Step 2 — Set Boundaries

Identify an appropriate spatial and temporal boundary for each resource. The temporal boundaries are noted above and the spatial boundary for each resource topic is listed under each topic.

Step 3 — Identify Cumulative Action Scenario

Determine which past, present, and reasonably foreseeable future actions to include with each resource. Reasonably foreseeable future actions include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a reasonable official of ordinary prudence would take such activities into account in reaching a decision. These activities include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite (U.S. Department of the Interior NEPA regulations 43 CFR 46.30).

Past, present and reasonably foreseeable future actions are listed in table 38 and described in chapter 1.

Step 4 — Cumulative Impact Analysis

Summarize impacts of these other actions (x) plus impacts of the proposed action (the alternative being evaluated) (y), to arrive at the total cumulative impact (z). This analysis is included for each resource in chapter 4.

WILDLIFE AND WILDLIFE HABITAT, INCLUDING RARE, UNIQUE, THREATENED, OR ENDANGERED SPECIES, AND SPECIES OF CONCERN

GUIDING REGULATIONS AND POLICIES

Servicewide NPS regulations and policies, including the NPS Organic Act of 1916, NPS *Management Policies 2006* (NPS 2006a), and the NPS Natural Resource Management Reference Manual 77, direct national parks to provide for the protection of park resources. The Organic Act directs national parks to conserve "wild life" unimpaired for future generations and is interpreted to mean that native animal and plant life is to be protected and perpetuated as part of a park unit's natural ecosystem.

The NPS *Management Policies 2006* state that the NPS "will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems. The term "plants and animals" refers to all five of the commonly recognized kingdoms of living things and includes such groups as flowering plants, ferns, mosses, lichens, algae, fungi, bacteria, mammals, birds, reptiles, amphibians, fishes, insects, worms, crustaceans, and microscopic plants or animals" (NPS 2006a). The NPS will achieve this by

- Preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur
- Restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions
- Minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them (NPS 2006a).

Section 4.1 of NPS *Management Policies 2006* states that "natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service will not attempt to solely preserve individual species (except threatened or endangered species) or individual natural processes; rather, it will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems" (NPS 2006a). According to Section 8.2.2.1 of the NPS *Management Policies 2006*, "Superintendents will develop and implement visitor use management plans and take action, as appropriate, to ensure that recreational uses and activities in the park are consistent with its authorizing legislation or proclamation and do not cause unacceptable impacts on park resources or values" (NPS 2006a).

The NPS adheres to the North American Wildlife Conservation Model, which focuses on the health and management of wildlife *populations.* Overall, goal of the NPS is to minimize human impacts (including impacts to individual wildlife) and avoid significant effects from disturbance to the abundance, diversity, dynamics, distributions, habitats, and behaviors of wildlife populations and communities and ecosystems in which they occur, pursuant to 36 CFR 2.18 and NPS *Mangement Policies 2006*, section 4.4.1. Although the focus of the impact analysis is predominantly the impacts to wildlife populations, the NPS acknowledges that adverse impacts to individual animals would likely occur and seeks to minimize them. In addition to NPS management policies, federally listed species in national parks are protected by the Endangered Species Act (ESA). The ESA (16 USC 1531 et seq.) mandates all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may affect a federally listed species, consultation with the U.S. Fish and Wildlife Service (USFWS) is required to ensure that the action would not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. NPS *Management Policies 2006* state that the NPS will survey for, protect, and strive to recover all species native to NPS units that are listed under the ESA, and proactively conserve listed species and prevent detrimental effects on these species (NPS 2006a, sec. 4.4.2.3). NPS *Management Policies 2006* also state that "[the NPS will] manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible" (NPS 2006a, sec. 4.4.2.3).

ASSUMPTIONS, METHODOLOGY, AND INTENSITY DEFINITIONS

Assumptions and Methodology

The impact analysis for wildlife and wildlife habitats was conducted separately for the individual species that had the potential to be impacted by each alternative. For each species, specific assumptions are provided; the impacts to the species from specific indicators are detailed. Impact findings for all species draw from the Scientific Assessment of Yellowstone National Park Winter Use (available at the Yellowstone Winter Use website at http://www.nps.gov/yell/planyourvisit/winteruse.htm and the Planning, Environment, and Public Comment (PEPC) website at http://parkplanning.nps.gov/yell).

Intensity Definitions

Negligible: There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them.

Minor: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Responses by relatively few individuals could be expected. Small changes to local population numbers, population structure, and other demographic factors might occur. Some impacts might occur during critical reproduction periods for a species, but would not result in injury or mortality. Sufficient habitat in the park would remain functional to maintain a sustainable population in the park.

Moderate: Impacts on native species, their habitats, or the natural processes sustaining them would be small but detectable at the population level. Responses by limited numbers of individuals could be expected, with some negative impacts to feeding, reproduction, resting, or other factors affecting local population levels. Some impacts might occur during critical periods of reproduction or in key habitats in the park and result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and habitat in the park would remain functional to maintain a sustainable population in the park.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and would be permanent. Responses by many individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in park population levels or a failure to restore levels that are needed to maintain a sustainable population in the park. Impacts would occur during critical periods of reproduction or in key habitats in the park and result in direct mortality or loss of habitat. Local population numbers, population structure, and other demographic factors might experience large declines.

In addition to the analysis presented below, the ESA (16 USC 1531 et seq.) protects specific species and their habitats throughout the country including in national parks. The ESA mandates all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. The NPS determination for the preferred alternative is alternative 7. If the NPS determines that an action may affect a federally listed species, consultation with the USFWS would be completed prior to the release of the final plan/EIS.

Study Area

The study area for assessment of the various alternatives is the park. The study area for the cumulative impacts analysis is the park plus the lands adjacent to the park's boundaries.

SUMMARY OF IMPACTS (ALL SPECIES)

Impacts of actions to wildlife species proposed in each alternative were analyzed below based on four major concerns: displacement impacts; behavioral responses of wildlife groups to OSVs and associated human activities; physiological responses of wildlife groups and individuals to OSVs and associated human activities; and demographic effects at the population level. Each wildlife species section starts with an overall summary of each of the major concern topics and corresponding effects on wildlife, followed by detailed impact analysis of each alternative.

- Alternative 1 would greatly reduce OSV use in the park, allowing only administrative OSV use. With the reduction in use, no observable impact would occur to the wildlife species analyzed (bison, elk, trumpeter swans, eagles, lynx, wolverines, and wolves); therefore impacts would be short- and long-term, negligible, adverse for all species under alternative 1. Impacts to lynx and wolverines would be long-term beneficial due to the absence of OSV use and only occasional backcountry skier use at the east entrance.
- Alternative 2 would allow for use levels similar to the 2009 interim rule (up to 318 snowmobiles and 78 snowcoaches) with best available technology (BAT) requirements, commercial guiding regulations, speed limits, and restrictions on OSV access to park roads only. Continued

monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Overall impacts under alternative 2 would be short and long-term minor to moderate adverse for bison and elk, because encounters with OSVs would still occur, but would not cause population-level impacts. Impact to lynx and wolverines would be long-term minor adverse because OSV use near the east entrance would be limited to five groups of OSVs a day, reducing the potential for encounters with OSVs, where these two species are known to occur. If these species were to travel outside of the eastern sector of the park, impacts could be long-term moderate adverse due to the possibility of more frequent encounters with OSVs. Trumpeter swans, eagles, and wolves would experience short- to long-term negligible to minor adverse impacts, because OSV management, including commercial guiding requirements and use restrictions, would limit encounters between OSVs and these species.

- Alternative 3 would allow for daily use limits of up to 720 snowmobiles and 78 snowcoaches along with BAT requirements, commercial guiding regulations, speed limits, and restrictions on OSV access to park roads only would result in short- and long-term minor to moderate adverse impacts on bison and elk because encounters with OSV would still occur, but would not cause population-level impacts. Impacts to lynx and wolverines would be long-term moderate adverse because OSV use, and the potential for encounters with OSVs, where they are known to occur (near the east entrance of the park) would be limited to five groups of OSVs a day, with overall levels of OSV use in other areas of the park possibly impacting these species. Trumpeter swans, eagles, and wolves would experience short- to long-term minor adverse impacts, because OSV management, including commercial guiding requirements and use restrictions, would limit encounters between OSVs and these species but overall use levels would be at a higher level.
- Alternative 4 would allow for daily use limits of up to 110 snowmobiles, 100 guided, commercial wheeled vehicles, and 30 snowcoaches, along with BAT requirements, commercial guiding regulations, speed limits, plowing design, and restrictions on OSV access to park roads only. This alternative would result in short- and long-term, negligible to minor adverse impacts on bison and elk, because a limited number of encounters would occur. Impacts to lynx and wolverines would be short-and long-term minor adverse, because OSV use and the potential for encounters with OSVs, where they are known to occur (near the east entrance of the park) would not occur because this entrance would be closed under alternative 4. The absence of human presence at this entrance would have long-term beneficial impacts. Trumpeter swans and eagles would experience short- to long-term negligible adverse impacts and wolves would experience short- to long-term negligible to minor impacts, because OSV management, including commercial guiding requirements and use restrictions, would limit encounters between OSVs and these species and the overall number of OSVs would be lower than those that have historically resulted in observable impacts to wildlife species.
- Under alternative 5, daily use levels would be the same as under alternative 2, but would vary between 318 commercially guided snowmobiles and 78 commercially guided snowcoaches and 0 snowmobiles and 120 commercially guided snowcoaches, depending on user demand, and until (if) the transition to snowcoach only occurs. The existing data suggest that the higher visual profile of a snowcoach may elicit stronger bison and elk behavioral responses than snowmobiles. Therefore, restricting OSVs to just commercially guided snowcoaches would not eliminate adverse effects on wildlife. However, due to the lower number of OSVs in the park, compared to impacts shown in studies on the current level of OSV use, impacts on bison and elk would be short and long-term minor adverse. Impacts to lynx and wolverines would be short-and long-term minor adverse because the level of OSV use would be expected to have few impacts on reproductive success, dispersal, and overall genetic sustainability of the species. Trumpeter swans and eagles would experience short- to long-term negligible adverse impacts and wolves would

experience short- to long-term negligible to minor adverse impacts, because OSV management, including commercial guiding requirements and low use limits, would limit encounters between OSVs and these species.

- Alternative 6 would allow for variable use levels, with OSV use ranging from zero to 540 snowmobiles per day and zero to 78 snowcoaches per day over the season. Unguided/non-commercially guided use would account for up to 25% of snowmobile users per day. This variable level would likely increase the behavioral responses of bison and elk due to daily unpredictability and reduced potential for habituation. Impacts under alternative 6 to bison and elk would be long-term minor to moderate adverse, due to unguided/non-commercially guided provisions, variable use limits, and increased group size. Impacts to lynx and wolverines would be long-term moderate adverse due to the increased presence of OSVs and the potential for higher OSV entry use at the east entrance during high use days, and due to the unguided/non-commercially guided component that could increase impacts on reproductive success, dispersal, and overall genetic sustainability of the species. Trumpeter swans, eagles, and wolves would experience long-term minor to moderate adverse impacts because OSV management, including commercial guiding requirements and use restrictions, would limit encounters between OSVs and these species, but increased use limits would increase the potential for impacts.
- Alternative 7 would allow for use levels similar to alternative 2 (similar use levels to the 2009 interim rule), of up to 318 snowmobiles and 78 snowcoaches per day, with BAT requirements, commercial guiding regulations, speed limits, and restrictions on OSV access to park roads only. Variable use limits under alternative 7 would allow the park to more effectively monitor impacts to wildlife under the adaptive management framework. Overall impacts for alternative 7 would be short and long-term minor to moderate adverse for bison and elk. Impacts to lynx and wolverines would be long-term minor adverse, with the potential for long-term moderate adverse, as described under alternative 2. Trumpeter swans, eagles, and wolves, would experience short- to long-term negligible to minor adverse impacts because OSV management, including commercial guiding requirements and use restrictions, would limit encounters between OSVs and these species

DETAILED IMPACT ANALYSIS

BISON AND ELK

Bison and elk are large ungulates with herds that winter in the park. These two species are more frequently encountered by OSV users than other wildlife species in the park. Both species are readily observed by OSVs and provide ample opportunities for wildlife viewing. These species are combined for analysis because they are similar in habitat preference, winter in Yellowstone's north and central ranges, are herbivorous, are active and mobile during winter, and have been extensively analyzed in relation to winter use.

General Description of Potential Impacts

Displacement of Bison and Elk

As discussed in chapter 3, elk and bison displacement due to OSV use in the park appears to be localized and short term. Even during the highest historical OSV use levels in the park, bison and elk continued to occupy their historical winter range in the Madison and Firehole drainages of Yellowstone. Consequently, the following analyses assume that increases in OSV use would cause short-term localized displacement, but not long-term displacement, in large part because the winter use season lasts less than 90 days. Also as discussed in "Chapter 3: Affected Environment," particularly in regard to bison, this analysis proceeded with the understanding that groomed roads are not the primary factor influencing bison population dynamics or westward range expansion of bison.

Behavioral Responses of Bison and Elk

Bison and elk behavioral responses to OSVs in Yellowstone suggest some level of habituation. The level and frequency of observed responses to OSVs are lower than those demonstrated by bison, elk, and other ungulates in areas of North America outside Yellowstone (White et al. 2008; Hardy 2001). These responses are species-specific, and comparison of Yellowstone's bison and elk to other ungulates, or to elk or bison in parks with more variable use or different levels of use, may be a poor basis for these conclusions. For example, Yellowstone's elk exhibited an increase in the likelihood of a vigilance response as cumulative OSV traffic increased over the course of a winter. In contrast, the likelihood of a vigilance response by bison decreased in winters with high visitation. Movement responses by both bison and elk appeared unchanged at 8%–9% of observed interactions (White et al. 2006).

When wildlife are frequently disturbed, the animals may demonstrate fewer visible responses to disturbance, which may be evidence of habituation. It is difficult to determine whether an animal is habituated to a disturbance, or if another process is occurring, because wildlife responses to disturbance stimuli vary from species to species, and between individuals of the same species. Therefore, there is no generalized pattern of behavior by all species or individuals within a species that demonstrates habituation. Behavioral responses by an animal may vary with sex, age, nutritional status, time of year, animal group size, and predation pressure. What causes an animal to move from a disturbed area depends on a number of factors including the quality of the site occupied, distance to and quality of other sites, relative risk of predation or competition, dominance rank, and investment a given individual has made in its current site.

In studies of changing wildlife response to human disturbance, it is also important to try to distinguish between habituation and tolerance. Habituation occurs when animals diminish their responses because the threats are increasingly viewed as non-threatening. This may help the animals avoid undue energetic expenditures, but can make habituated animals more vulnerable to natural predators. Tolerance may occur, for example, when responses are diminished because the animals cannot afford to move from a disturbed area in the face of needing to maintain food intake.

A predictable daily pattern of OSV use, such as that which occurs with guided OSV use only, would be more likely to decrease overall behavioral responses by bison and elk throughout the winter, because animals are more likely to become habituated to a disturbance if it is predictable in time and space, not directly harmful, and limited in duration (Thompson and Henderson 1998; White et al. 2008). Also, the frequency of exposure to OSV disturbance (which may increase with higher allowable use limits) is an important consideration when assessing the likelihood of habituation, because there appears to be a threshold of disturbance at which wildlife are no longer able to habituate (White and Thurow 1985; Steidl and Anthony 2000). This threshold is generally species-specific and may be reached more quickly if a disturbance is novel, represents a greater threat, or occurs during a time of additional stress, such as increased predation pressure, harsh winters, or low food availability.

An issue raised by commenters in past planning processes is that oversnow vehicle numbers under the action alternative scenarios below would exceed those recommended by wildlife biologists. That is not the case. Park wildlife biologists have recommended that oversnow use be limited to the numbers observed during the "past three years of their study" (referring to the 2001 – 2004 period) (for example, a memo by P.J. White of November 9, 2008). This has been interpreted by some to mean that snowmobile use should be limited to no more than approximately 260 snowmobiles per day and snowcoaches be limited to no more than approximately 30 per day (e.g., 2001-2004 period). Subsequent additional reports by the same authors discuss a wider cumulative timeframe (1999-2006), that included higher levels of winter use than were observed in 2001-2004. The current definitive report on this topic is the peer reviewed scientific article entitled "Behavioral Responses of Bison and Elk in Yellowstone to Snowmobiles and Snow Coaches" (Borkowski et al. 2006) (see P.J. White memo of Oct 14, 2009). On pages 1911-1925 of this journal article, the authors make it clear that the cumulative monitoring period they are referring to is from 1999 -2004 that included average daily oversnow vehicle use up to 593 per day (2002), maximum daily numbers extended up to 1168 oversnow vehicles (1998), and cumulative oversnow vehicle entries for the winter season at the West Entrance alone up to 46,885 (2002). The results of this paper are considered in the impact analysis below.

Although habituation is an impact that is difficult to predict and even more difficult to quantify, behavioral data indicate that more recreationists produce behavioral responses in a larger number of individual animals, a data-based assumption that is carried forward in the following analyses. Another assumption based on behavioral data is that the use of commercial guides may help to reduce interactions that result in energetically costly movement responses by wildlife (e.g., flight), because guides are trained to limit their groups' interaction time with animals, to prevent wildlife harassment and chasing, and to control the distance at which their groups approach animals. Similarly, based on experience and familiarity with the wildlife behavior and with factors that may contribute to active responses by animals, guides may be able to recognize and minimize those situations where two or more factors such as distance of the wildlife group to the road and interaction time, may increase wildlife stress and exacerbate behavioral responses.

Physiological Reponses of Bison and Elk

The majority of responses by wildlife documented in Yellowstone have been low-intensity vigilance (look and resume) or, more rarely, sustained movement (travel) (Borkowski et al. 2006; White et al. 2006). The fact that an animal exhibits no visible external response does not mean physiological responses are absent. Apparent habituation, as demonstrated by behavioral studies on bison and elk, may be due to an array of other factors resulting in decreases in visible response. These other factors may adversely affect bison or elk heart rate, stress levels, habitat use, and foraging time. No comprehensive studies have analyzed the energetic effects of bison and elk behavioral responses to OSV in Yellowstone, due in part to the difficulties associated with separating the energetic costs associated specifically with responses to OSVs from the total daily energy expenditure (Borkowski et al. 2006). Numerous assumptions are required when making energy analyses, and poorly defined parameter estimates can strongly affect research and outcomes. Despite apparent low-level behavioral responses, associated physiological responses by bison and elk could increase the potential impacts of winter stress on some animals and decrease winter survival and spring reproductive rates of animals thus affected (Gill et al. 2001). Given the difficulties with quantitatively analyzing physiological responses to recreationists by wildlife, analyses for this document were made on the qualitative but conservative assumptions that increasing levels of disturbance, including OSV traffic, would likely result in increased stress to wintering wildlife (Hardy 2001; Creel et al. 2002).

Population-Level Impacts/Demographics

As discussed in "Chapter 3: Affected Environment," researchers have not observed that OSV use and winter recreation in Yellowstone have affected bison and elk at the population level. An unknown number of individual bison and elk would incur adverse effects when exposed to OSV traffic, wheeled vehicles and winter recreation under the alternatives of this EIS. Behavioral monitoring (winter 1999 to winter 2009) found that 8%–10% of bison and elk displayed active responses including travel, flight, alert-attention, and defense (White et al. 2008). Small numbers or groups of bison and elk may be displaced, demonstrate increased physiological and stress responses and/or demonstrate increased vigilance or active movement responses. Mitigation measures listed under each alternative strive to minimize the frequency and intensity of impacts to individual animals.

Overall, based on the available science and literature and the research summarized in "Chapter 3: Affected Environment," it was assumed for the following analyses that those forms of winter recreation practiced in the park may have cumulative effects on individual animals, but that such impacts have not risen to the level at which they exceed minor adverse impacts on wildlife populations in the park.

Bison and Elk Responses to Non-Motorized Users

Bison and elk may occasionally respond to skiers and snowshoers; however, the overall frequency of interactions and behavioral, physiological, and/or displacement effects on bison or elk is quite low. This is primarily because few people travel far from roads, established trails, or other areas of concentrated human activity (e.g., Geyser Basin trails, Old Faithful Visitor Education Center, warming huts). Ski and snowshoe trails in Yellowstone are managed as wilderness, with groomed tracks set on only a few snow roads. The difficulties associated with non-motorized winter travel in the park (e.g., limited daylight, extreme cold and wind, poor visibility, drifted or deep snow, storms), restrict most of these users to within two miles of motorized-accessible travel corridors and restrict total daily movements of skiers or snowshoers, which further limits the potential for an encounter (NPS 2008a). During periods of extreme weather, areas of the park may be closed to backcountry use to protect wildlife (see the "Adaptive Management" section in chapter 2). Visitors are instructed to maintain a distance of at least 25 yards from bison and elk, and it is illegal to approach bison or elk in a way that precipitates any behavioral response (NPS 2010e).

Non-motorized uses during the winter season include cross-country skiers and snowshoers. Interactions between these users and wildlife are rare due to the difficulties associated with non-motorized winter travel in the park (limited daylight, extreme cold and wind, poor visibility, drifted or deep snow, storms). These conditions restrict most of these users to within two miles of motorized-accessible travel corridors and restrict total daily movements of skiers or snowshoers, which further limits the potential for an encounter. Interactions with non-motorized users in the front country accounts for less than 1% of observed interactions between wildlife and winter users during winters 2007 to 2009, compared to those between OSVs and wildlife, and 100% of these encounters have elicited no visible response over the past three winter seasons as observed during annual wildlife monitoring.

Researchers in areas outside of Yellowstone have observed that non-motorized users elicit similar levels of wildlife behavioral responses as motorized users. Therefore, non-motorized users may elicit physiological or behavioral responses in bison or elk, but encounters between non-motorized users and wildlife are relatively rare.

No observations or monitoring have documented non-motorized users and corresponding bison and elk responses in backcountry areas except for Cassirer et al. (1992), which found that elk in Yellowstone demonstrated strong flight and physiological responses to skiers who were travelling in the backcountry. The vast majority of winter visitors to the park travel in the front country, and do not visit the backcountry areas where this study was conducted. Thus, non-motorized users generally encounter animals that are also exposed to OSVs, and associated human presence. This is demonstrated by observations of wildlife responses in winters 2007 to 2009, within 2 miles of motorized corridors conducted in the front country along groomed OSV roads.

In contrast to the high level responses Cassirer et al. (1992) observed by elk in the backcountry, observations in the front country, along groomed road corridors, found that bison and elk never showed a visible response to skiers or snowshoers out of a total of 16 observed interactions. These interactions with skiers or snowshoers accounted for less than 1% of all observed wildlife-human interaction events observed during the course of the three winter seasons 2007/2008 to 2009/2010 (Davis et al. 2007; McClure et al. 2008; McClure et al. 2009). Wildlife response monitoring data indicate that bison or elk encounters with skiers and snowshoers were relatively rare along OSV routes and, when they did occur, there was almost never any visible response by the wildlife to non-motorized users. Encounters between non-motorized users that occur in other areas of the park, such as along groomed ski trails or in backcountry off of the road, have not been monitored, but the number and location of these trails would not vary between alternative, and such encounters with non-motorized users in the backcountry would continue under any alternative. Researchers working outside of Yellowstone observed that non-motorized users elicit similar behavioral responses in bison compared to behavioral responses elicited by OSV users, but this study was conducted in areas with lower visitor use levels and different use timing and intensity, making it a poor comparison to Yellowstone (Fortin and Andruskiw 2003).

Thus, although non-motorized recreationists allowed under any of the proposed alternatives may occasionally elicit movement or vigilance responses from bison and elk, and also may cause associated physiological effects, the effects would be minimal and would occur rarely in Yellowstone. Because the number of interactions between non-motorized users and wildlife are rare (less than 1% of observed interactions between wildlife and winter users over the winter seasons from 2007/2008 to 2009/2010) compared to those between OSVs and wildlife, and 100% of these encounters have elicited no visible response over winter seasons 2007/2008 to 2009/2010 based on wildlife monitoring reports, non-motorized users are expected to have short-term negligible adverse impacts on bison and elk across all alternatives. Therefore, this discussion is not included separately under each alternative.

Vehicle-caused Mortality

Bison and elk OSV collision mortality during both historical and current levels of OSV use in Yellowstone is rare. Most road kill mortalities result from collisions with wheeled vehicles, and occur year round, not just during the winter months. Few OSV-caused road kills occurred even when the level of use was higher (up to a daily average of 950 snowmobiles) than the current levels (White et al. 2008). During the winters from 1989 to 1998, when winter use was not managed, only 10 bison, 3 elk, 2 coyotes, 1 red fox, and 1 pine marten were reported killed by snowmobiles in Yellowstone. In contrast, 98 bison, 427 elk, 75 coyotes, 84 moose, and 406 other large mammals (e.g., bighorn sheep, deer, pronghorn, wolves) were killed by wheeled vehicles in Yellowstone during the winter and summer seasons from 1989 to 1998 (Gunther et al. 1998). In sum, of the total 1,080 animals killed by motorized vehicles between 1989 and 1998, only 17 animals were killed by OSVs during the winter season. No animals have ever been reported killed by snowcoaches and, since guiding requirements were established, no wildlife deaths have been reported due to collisions with OSVs. Alternative 4, which would allow up to 100 wheeled vehicles into the park per day, would minimize wildlife collisions by requiring buses to be operated by trained guides who are experienced with winter driving and the location of wildlife. Thus, the probability of wildlife collisions from these vehicles would be similar to that from snowcoaches, at around zero. Alternative 6 would allow up to 25% of snowmobiles entering the park to be unguided or non-commercially guided, which would result in a lower number of unguided snowmobiles in the park than from 1989 to 1998. The probability of these vehicles colliding with bison or elk would be low. Therefore, the impacts to bison and elk from OSV-collision mortality would be negligible adverse under all alternatives, and thus are not discussed separately under each alternative.

When determining impacts under the following alternatives, the data used were generally collected from ongoing monitoring of the bison and elk in Yellowstone rather than through modeling or simulation. However, modeling or simulation are useful tools by which to discuss the long-term implications of certain alternatives, and therefore modeling results are included when useful or applicable.

IMPACTS ON BISON AND ELK BY ALTERNATIVE

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Displacement of Individual Animals

Under alternative 1, OSV traffic through bison and elk ranges would be greatly reduced to a nominal level (fewer than 20 OSVs in the park per day based on administrative needs). Thus, the potential for displacement by individual animals would be decreased to nearly zero. Impacts of displacement of individual animals under alternative 1 would be localized, short-term, negligible, and adverse.

Behavioral and Physiological Responses

Under alternative 1, the number of winter use encounters would be fewer than 20 per day and the potential for bison and elk to be adversely affected or to have physiological responses would be minimized. This alternative reduces the potential for behavioral responses and would have localized short-term negligible adverse impacts.

Population-level Impacts

After establishment of the park, bison and elk populations in Yellowstone were actively managed by the park, which kept their population at a pre-determined level. This type of culling to reach a pre-set population stopped in the 1960s. At this time, OSV routes and OSVs were introduced to the park, and bison crossing park boundaries continue to be culled by the state of Montana and the NPS. Because there was never a time without either active management or OSV use, the overall bison and elk populations, as well as individual bison and elk, have been subject to various degrees of direct and indirect human influence since the founding of Yellowstone. Therefore, it is difficult to predict what effect, if any, the absence of groomed roads may have on bison movements. Studies show that elk do not use groomed road corridors for travel to the same extent as bison, and that elk home range and movement patterns have remained stable during the period in which winter recreation became prevalent in Yellowstone. Many of the road corridors are in locations that are natural migration paths for bison, such as along riverbanks and in valleys between steep-sided canyons. Thus, road grooming in these areas may not affect bison migration and travel routes, as self-groomed bison trail corridors would likely occur in these areas even in the absence of park roads or road grooming.

There is a vast library of research and modeling on bison population growth and westward range expansion. Most researchers have concluded that bison population growth is based primarily on the cessation of active management and culling of the park's bison population, rather than any energetic savings and associated increased survival from travel on groomed OSV routes (Bjornlie and Garrott 2001; Gates et al. 2005; Bruggeman et al. 2009a; Plumb et al. 2009; White et al. 2008). No population-level impacts have been documented on bison or elk from OSV and/or other human-caused disturbance, or the presence of groomed roads. Coughenour (2005) proposed a possible minimal decrease in bison survival, due to increased energetic costs, from travel through deep snow in the absence of groomed roads. With very little OSV travel in the park, the energetic costs associated with movement through deep snow in the absence of groomed roads may be offset by the energy savings due to greatly reduced alert time and flight responses by bison to OSVs. Under this alternative, OSV use in the park would be minimal; therefore, bison and elk would only rarely exhibit flight behavior due to OSVs. Additionally, bison are naturally adapted to travel in deep snow and form self-groomed trails (Gates et al. 2005). Even in the absence of road grooming, many of these trails would likely overlap park roads, because park roads are multi-season wildlife travel corridors. Although it is difficult to differentiate between the additional movement costs that may be associated with travel through deep snow, and the energy savings due to lack of active movement responses, it is likely that costs and benefits would more or less balance out for bison. Therefore, population-level impacts are predicted to be long-term negligible, and adverse; any population changes due to the absence of groomed roads in the park, or to low OSV levels, would likely take place over the course of several decades. Park managers conduct annual population counts of bison, but the cause and effect of bison population fluctuations are difficult to determine. The contribution of OSV use on bison mortality is hard to distinguish from the impacts of severe winter weather, bison control measures including culling, or predation pressure.

Cumulative Impacts

Past, current, and future planning efforts by the NPS have affected bison and elk populations in Yellowstone. Prior to 1969, populations were maintained at predetermined levels by park management. These levels were met through lethal control of the herds, resulting in major, short- and long-term impacts on bison and elk. After active population management ceased, bison and elk populations grew rapidly, with approximately 3,100 bison culled by park management or the state of Montana from 1984 to 2000. In 2000, an IBMP endorsed by the federal government and the state of Montana, established guidelines for managing the risk of brucellosis transmission from bison to cattle. In 2008, adaptive adjustments to the IBMP were set in place to provide for additional management activities as identified below.

Bison leaving Yellowstone are currently subject to management control at the park boundary, pursuant to the 2008 adaptive adjustments to the IBMP and the 2000 IBMP (NPS 2000b, 2008a). New policies allow untested females or mixed groups of bison to migrate onto and occupy Horse Butte peninsula and the Flats each winter and during spring calving season. Controls include hazing bison back into the park in May, lethal removal, and retaining animals in facilities for brucellosis testing and eventual release or culling. If populations drop below 2,300 bison, the agencies increase implementation of non-lethal measures and, if populations drop below 2,100 bison, agencies cease lethal management and hunting and shift to non-lethal management measures. The IBMP Adaptive Adjustments to the 2000 IBMP (NPS 2008a) also calls for an increase in bison vaccinations via completion of the EIS processes for remote delivery vaccination of bison and to use the outcome of the EIS and NEPA process to determine active management practices. The goal of the proposed Brucellosis Remote Vaccination Program for Bison is to protect Yellowstone bison by reducing brucellosis infection and, ultimately, further reduce risk of transmission to cattle outside of the park. If this program, and other measures implemented under the 2008 Adaptive Adjustments are successful, hazing and lethal control of Yellowstone bison that travel beyond the park’s border may become unnecessary, or occur less frequently, and bison may continue the westward expansion of their range into Montana. This may have an overall positive impact on the bison population in the greater Yellowstone area and may result in increased range and forage availability, nutritional uptake, and total population growth of bison if they are allowed to access and remain in suitable habitat outside of park boundaries. If bison expand their range, there may be decreased population density, and reduced mortality of new-born calves, which are currently subject to hazing (in the Horse Butte area). Decreased population density may result in better body condition and increased reproductive success of cows. However, current management practices limit any western range expansion of Yellowstone bison, which in turn limit natural density dependent dispersal of bison, and the control methods currently used have an overall long-term minor to major adverse impact on bison population and viability. Impacts from these actions would depend on the success of a long-term remote brucellosis vaccination program. Short-term impacts would be adverse, minor to major, and direct (based on how many bison are culled each year, which is a direct result of the number of bison that leave the park, which in turn primarily depends on winter severity and the number of consecutive harsh winters). Long-term impacts may range from negligible to moderate adverse, because implementation of the remote brucellosis vaccine program would likely have some success in reducing the number of infected bison and may in the future limit or eliminate the need for culling.

The Gallatin National Forest has consolidated the checkerboard of private and public holdings in recent years, accompanied by a consolidation of private holdings, including within the Big Sky Area. It is difficult to predict the net effect of these actions on bison and elk, since the consolidated U.S. Forest Service (USFS) lands are less likely to be developed, whereas the private lands are more likely to be developed. Current actions also include reclamation of McClaren Mine tailings (MTDEQ 2010b) and Gardiner Basin and Cutler Meadows restoration. These actions would have variable effects on bison and elk, sometimes stimulating the growth of their preferred forage and habitat and sometimes limiting it, due to providing or fragmenting habitat for these species.

Future highway-and vehicle travel related plans include the Gallatin Travel Plan revision, and the Beartooth District of Custer National Forest Travel Management Plan. Whereas plans in the national forest are designed to minimize adverse impacts on wildlife, regional plans designed to increase ease of travel for vehicles may not prioritize wildlife. Any increases in traffic, road width, and the number of roads may have long-term adverse impacts on bison and elk in the greater Yellowstone area. Additional roads and vehicles may lead to increased mortality caused by vehicle collisions, limited dispersal and travel of bison or elk to new habitat or preferred habitat locations, and habitat fragmentation. Impacts due to highway plans and road development would be long-term, ranging from minor to moderate adverse.

The reintroduction of gray wolves has contributed to decreases in the elk population in the greater Yellowstone area from the mid 1990s to present, because elk are the primary prey of wolves in the park (White and Garrott 2005, Christianson and Creel 2010). The driving force behind the elk population decline is unclear, and the decline has been attributed to one or more factors other than wolves, including changes in vegetation, hunting, drought, and other variations in the ecosystem, with grizzly bears, rather than wolves, observed to be the primary predator of elk calves (Creel and Christianson 2008; Barber-Meyer et al. 2008). Regardless of whether they precipitated the elk population decline, the presence of wolves increases the predation pressure on elk. The presence of wolves possibly increases the behavioral and physiological responses of elk to anything perceived as a predation threat, including OSVs, humans, and sound from OSVs (Creel and Christianson 2008). Increased responses by elk to winter users may increase stress levels, energy expenditure, and displacement, and decrease energy intake, potentially resulting in poorer body condition, decreased reproductive rates, and an overall decrease in survival (White et al. 2008; Creel 2009; Christianson and Creel 2010). The same is true, but to a much lesser degree, for bison. Bison calves are subject to predation by wolves (Barber et al. 2005), but wolves generally avoid attacking a full-grown bison due the risk of injury and the difficulty in taking down a large adult animal. Therefore, although impacts by wolves on elk populations are unclear, the increase in perceived predation risk may increase the behavioral and physiological responses by elk and possibly bison, to winter users.

Major cumulative impacts would occur due to bison management and control measures under the IBMP, which is unrelated to direct impacts of winter use in the park. The long-term negligible to major impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible adverse impacts of alternative 1, would result in long-term minor to major adverse cumulative impacts on bison and elk, of which winter use activities would comprise a small part.

Conclusion

Based on an analysis of the available data and literature regarding bison and elk in the greater Yellowstone area, the no-action alternative would result in short and long-term negligible adverse impacts on bison and elk in the park, because OSV use would be limited to minimal administrative use and non-motorized use would be more limited, resulting in no observable impacts. Human activity during the winter months would be reduced and any beneficial wildlife impacts would likely only be apparent over several decades of minimal OSV traffic in the park. Cumulative impacts under alternative 1 would be long-term minor to major adverse. Alternative 1 would contribute minimally to cumulative impacts because there would be no visitor OSVs in the park

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Displacement of Individuals

The level of OSV use under alternative 2 (up to 318 snowmobiles and 78 snowcoaches) would be equal to that permitted under the currently implemented 2009 interim rule. There has not been any observed long-term displacement of bison or elk from 1969 to present, based on observations from winter seasons when similar numbers of OSVs entered the park (winter 2003 to winter 2006, when daily OSV entrance numbers were 250-300), or during winter seasons with higher levels of use prior to 2003 (average 950 OSVs per day; White et al. 2008; McClure et al. 2009). Bison and elk have continued to use the same core winter ranges during the past three and a half decades, even when OSV use fluctuated dramatically from winter to winter (Craighead et al. 1973; Aune 1981; Hardy 2001). Thus range-wide displacement of individual bison or elk would be unlikely under alternative 2, because conditions similar to the existing condition would continue (where long-term displacement of individuals has not been observed). Although bison and elk may temporarily avoid areas of OSV use, resulting in short-term displacement, these short-term responses have not caused shifts in core winter habitat use.

Despite no observed large-scale shifts in habitat use due to the presence of OSVs in the park, both bison and elk have demonstrated flight from OSVs or avoidance of OSV use areas, resulting in small-scale, temporary shifts in habitat use by bison or elk (White et al. 2008). Although these displacement events are brief and temporary, if they occur frequently over the course of a winter, this may decrease both the amount of time elk, and to a lesser extent bison, have to feed, and may also increase energy demands due to movement. Because elk and bison generally suffer a decline in body condition associated with increased energy demands and poorer forage quality over the course of a winter, these factors may contribute to this energy imbalance. As a result, individual bison and elk that frequently avoid OSV use may demonstrate poorer body condition. However, despite short-term responses to OSVs, overall habitat use by bison and elk does not appear to be affected (Hardy 2001; White et al. 2008). Researchers attribute changes in distribution of elk during the winter primarily to snow mass and heterogeneity (Messer 2003). Researchers attribute changes in distribution of elk during the winter primarily to snow mass and the snow depth, snow type, and melting characteristics that are influenced by Yellowstone's many geothermal features and vary in both timing and location during Yellowstone's severe winters (Messer 2003). Researchers attribute bison distribution primarily to population density, snow characteristics, drought, and other factors affecting resource availability (Bruggeman et al. 2006).

Thus, displacement impacts to individual bison and elk under alternative 2 would be localized, short-term moderate adverse. Displacement events may be brief and temporary, and over the course of a winter such events may reduce energy consumption by elk, and to a lesser extent, bison, potentially resulting in poorer body condition.

Behavioral and Physiological Responses

Under all action alternatives, except alternative 6 where up to 25 % of snowmobile users would be non-commercially guided/unguided, trained guides would maintain buffer zones and instruct visitors to behave in a manner that minimizes the likelihood of a strong, energetically costly behavioral response by bison or elk (White et al. 2008). Based on the current managed use, guiding would also result in defined morning and evening peaks in OSV traffic, which may result in increased behavioral responses by ungulates during that time due to more concentrated OSV use. However, a predictable daily pattern of OSV use would be more likely to decrease overall behavioral responses by bison and elk throughout the winter. This is because animals are more likely to become habituated to a disturbance if it is predictable in time and space, not directly harmful, and limited in duration (Thompson and Henderson 1998; White et al. 2008). Depending on the frequency of OSV encounters, active responses by bison and elk (which based on studies would occur during 8% to 9% of encounters (Borkowski et al. 2006; White et al. 2008)) may result in minor or moderate energy costs. However, no adverse population-level effects would be expected, because there have been no observed impacts on population growth or demographics correlating to increased or decreased OSV use in the park over the last 38 years, including the winters from 2004 to 2009 where daily entrance numbers for OSVs (258 snowmobile and 30 snowcoach daily average) were similar to those proposed under alternative 2. Peak OSV use during the winters from 2004 to 2009 was 488 snowmobiles and 55 snowcoaches, which is above the daily limits proposed under alternative 2. Daily limits of up to 318 snowmobiles and 78 snowcoaches were not met in winter 2010 after implementation of the 2009 interim rule, with actual averages of only 187 snowmobiles and 32 snowcoaches per day. Based on behavioral observation from winters that had similar levels of use to those proposed under alternative 2 (winters 2006 to 2009), impacts to bison and elk resulting from continued OSV levels are predicted to be localized, short-term minor adverse under alternative 2.

Population-level Impacts

Historically, researchers have not observed population-level effects for bison and elk during periods of un-guided travel, and higher daily numbers of OSVs in the park. During recent wildlife behavioral monitoring, no short-term population-level effects from OSV use were observed for bison and elk, including when an average of 795 snowmobiles and 15 snowcoaches entered the park daily (Fuller 2006; White et al. 2008). Long-term impacts on populations could conceivably occur under this alternative if there were large-scale cumulative effects resulting from series of small-scale displacement, reduced forage intake, and increased energy expenditure resulting from behavioral responses. Over time these may lead to observable impacts on the population, but such impacts have not been observed under historical levels of use. Population-level impacts are predicted to be long-term minor adverse under alternative 2.

Cumulative Impacts

Impacts on bison and elk from other past, present, and reasonably foreseeable future would be the same as described for alternative 1. The major impacts stated are a result of bison control measures and management under the IBMP, which is unrelated to winter use in the park. The long-term negligible to major adverse impacts of these cumulative actions, when combined with the long-term minor to moderate adverse impacts of alternative 2, would result in long-term minor to major adverse cumulative impacts on these species. Implementation of alternative 2 would contribute only a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 2 would allow for use levels similar to the 2009 interim rule, with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Thus, overall impacts under alternative 2 would be short and long-term minor to moderate adverse. Cumulative impacts would be long-term minor to major adverse, of which alternative 2 would contribute minimally.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Displacement of Individuals

The level of OSV use under alternative 3 (up to 720 snowmobiles and 78 snowcoaches) would be similar to OSV use from winter 1995 to winter 2001 (Fuller 2006), when an average of 795 snowmobiles and 15 snowcoaches entered the park daily. There has been no observed long-term displacement of individual bison or elk from 1969 to present, and bison and elk have continued to use the same core winter ranges during the past three and a half decades, even when OSV use fluctuated dramatically from winter to winter (Craighead et al. 1973; Shea 1979; Aune 1981; Hardy 2001).

Studies have found that movement responses were observed during 8% to 9% of interactions with OSVs, meaning that the greater number of OSVs allowed into the park under this alternative would increase the number of times individual bison or elk would demonstrate an energetically costly movement response because the number of interactions would increase, resulting in minor to moderate impacts. Although displacement events may be brief and temporary over the course of a winter, the events may reduce the forage time and quality for elk, and to a lesser extent, bison, potentially resulting in poorer body condition, increased susceptibility to winter weather, and decreased reproductive rates. Displacement impacts to bison and elk under alternative 3 would be localized, short-term moderate adverse.

Behavioral and Physiological Responses

Depending on the frequency with which they occur, active responses by bison and elk may result in minor to moderate energy costs. No adverse population-level effects would be expected, based on population growth and behavioral responses at similar use levels to those proposed under alternative 3 (Borkowski et al. 2006; White et al. 2008). Any increase in OSV numbers entering the park, up to the daily limits, would be likely to increase bison and elk behavioral and physiological responses beyond those observed in the winters of 2004 to 2009, when use levels were less than proposed under alternative 3, ranging from 250 to 557 snowmobiles and to 60 snowcoaches per day. Therefore, impacts to bison and elk resulting from alternative 3 are predicted to be localized, short-term minor to moderate adverse.

Population-level Impacts

Population-level impacts would be long-term minor adverse under alternative 3 because no population-level effects from OSV use have been observed in bison and elk even during periods of higher permitted winter use than that proposed in alternative 3 (Fuller 2006; White et al. 2008). Specifically, the bison population increased exponentially from 1980 to 1994, despite a 20-fold increase in winter visitation during this same period. Also, the survival rate of female bison was high (96%) and remained constant from 1995 to 2001 (Fuller 2006), when an average of 795 snowmobiles and 15 snowcoaches entered the park daily, which are similar to the proposed 720 daily snowmobile limits under alternative 3 (same as 2004 rule).

Cumulative Impacts

Impacts on bison and elk from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The major impacts stated are a result of bison control measures and management under the IBMP, which is unrelated to winter use in the park. These long-term negligible to major adverse impacts, when combined with the long-term minor to moderate adverse impacts of alternative 3, would result in long-term minor to major adverse cumulative impacts. Implementation of alternative 3 would contribute a noticeable amount to cumulative impacts because of high daily entrance numbers.

Conclusion

Under alternative 3, daily use limits of up to 720 snowmobiles and 78 snowcoaches along with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only would result in short and long-term minor to moderate adverse impacts. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Cumulative impacts on bison and elk under alternative 3 would be long-term minor to major adverse.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Displacement of Individuals

Under alternative 4, the number of OSVs entering the park on a daily basis would be reduced from current levels up to 110 snowmobiles and 30 snowcoaches; alternative 4 would also provide for up to 100 commercial wheeled vehicles. Reducing the number of OSVs permitted in the park per day would decrease impacts related to displacement of individuals, because there would be less total exposure to OSVs over the course of the winter. Additionally, OSVs traveling from the south and through the east portions of the park would be traveling through areas where there are few, if any bison, further limiting impacts to that species. Any increase in the numbers of OSV groups in the park traveling through areas where bison and elk are present would increase the number of times that elk and bison are exposed to the presence of OSVs, the duration of exposure to sound produced by OSVs, and the total duration of time OSVs are visible (McClure et al. 2009; Burson 2004 to 2010). These factors have been found to increase the intensity of behavioral responses in wildlife, resulting in avoidance or changes in habitat use, and may also result in avoidance of OSV corridors by bison and elk, changing the localized use patterns of these species (Hardy 2001; White et al. 2008). Therefore, because the number of OSVs allowed in the park per day would decrease under alternative 4, as would the numbers of OSVs traveling through bison and elk habitat, the potential for displacement of individual bison and elk under alternative 4 would be reduced from the conditions on which the above studies are based.

Monitoring reports for current winter use have recorded high numbers of OSV-bison or elk interactions in habitats adjacent to the road corridor, and it is expected that if the roads were plowed and wheeled vehicles were permitted, this same level of interaction would occur. There may be congestion within the road corridor due to the road plowing because snow berms may prevent bison from exiting the road when encountering motorized vehicles, requiring vehicles to stop when encountering bison in the road. Snow berms may also make it difficult for bison or elk to enter or cross road corridors. However, a plowing design would be developed for wildlife that would include escape routes between the berms at appropriate intervals to minimize this problem. Providing such escape routes would be critical, especially during severe winters with heavy snow pack. During high snow years, high berms resulting from plowing could be formed on either side of the road, forming a corridor that may funnel wildlife along the road for a distance, unless escape routes are provided to allow for crossings and movement off of the road. Road plowing design would be intended to minimize such displacement of wildlife. There is very limited historical information available on bison and elk habitat use, movements, or dispersal prior to the construction of vehicle roads in the park; and this limited information is not comparable to recent scientific information.

Potential impacts to bison and elk from wheeled vehicles can be seen in the current interactions that occur in the winter along the northern road between Mammoth and Cooke City. Bison and elk populations in the northern section of Yellowstone have not been displaced along this section of roadway, which has higher use levels from wheeled vehicles than would occur under alternative 4 (100 wheeled vehicles per day), nor have bison and elk populations been displaced due to private wheeled vehicle travel during the summer (Craighead et al. 1973; Aune 1981; Hardy 2001). Therefore, it is unlikely that range disrupting displacement effects would occur with the low level of commercial (guided) wheeled vehicle use proposed under alternative 4, especially with a plowing design that allows for ample escape routes.

During high snow years, high berms resulting from plowing are formed on either side of the road, forming a corridor that may funnel wildlife along the road for a distance, unless escape routes are provided to allow for crossings and movement off of the road. Wildlife need to have egress from the road corridor to access food and shelter. A plowing design that provides escape routes for wildlife would be used, especially during severe winters with heavy snow pack.

Taken together, wheeled vehicles and OSV use under alternative 4 represent lower motorized vehicle numbers in the park during the winter season than historical levels. Although individual bison and elk may be displaced when exposed to OSVs and motorized vehicles, or funneled along the road for short stretches during high snow years, such effects would likely be short-term, and infrequent. Therefore, the impacts of displacement under alternative 4 are predicted to be localized, short-term minor adverse because, though displacement events may be brief and temporary over the course of a winter, this may reduce grazing time and amount of food consumed by elk and, to a lesser extent, bison, potentially resulting in poorer body condition.

Behavioral and Physiological Responses

Access by both wheeled vehicles and OSVs would be lower than historical use numbers, and bison and elk would likely have similar behavioral and associated physiological responses to wheeled commercial vehicles (e.g., buses, vans) as they have to snowcoaches. Wheeled traffic would occur on routes that are currently groomed for OSV use during the winter, and combined entrance levels for OSV and wheeled vehicles of 240 per day would be lower than the 396 total and 798 total permitted under alternatives 2 and 3, respectively. A sound level limit would be placed on wheeled vehicles. The sound level limit would limit the duration and distance at which wheeled vehicles could be heard, thus limiting duration and intensity of behavioral or physiological responses of bison or elk to motorized sounds in this area. Buses do have a larger visual presence than snowmobiles, and, like snowcoaches, may elicit more intense behavioral responses by bison, but less frequent vigilance responses (Borkowski et al. 2006; White et al. 2008). Therefore, due to the overall decrease in total daily vehicle limits, the limited area where wheeled vehicles would be able to access, and the corresponding decrease in OSVs on all other park roads, alternative 4 would have a low potential for interactions that would result in elk or bison movement or disruption of feeding that would result in decreased food intake and/or increased energy expenditure due to flight or travel. Impacts under alternative 4 would be long-term minor adverse due to the overall reduction in the frequency of interactions between motorized vehicles and bison or elk.

Population-level Impacts

No adverse population-level impacts to bison and elk have been detected under higher levels of winter use, as described above (Borkowski et al. 2006; White et al. 2008); therefore, a decreased level of use as proposed under alternative 4 should further minimize any undetected impacts on wildlife, resulting in no more than long-term negligible adverse impacts.

Cumulative Impacts

Impacts on bison and elk from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The major impacts stated are a result of bison control measures and management under the IBMP, which is unrelated to winter use in the park. These long-term negligible to major adverse impacts, when combined with the short and long-term negligible to minor adverse impacts of alternative 4, would result in long-term minor to major adverse cumulative impacts. Alternative 4 would reduce the daily number of vehicles entering the park and would contribute a small amount to the overall cumulative impacts to bison and elk.

Conclusion

Under alternative 4, daily use limits of up to 110 snowmobiles, 100 guided wheeled vehicles, and 30 snowcoaches, along with BAT requirements, guiding regulations, speed limits, plowing design, and restrictions on OSV access to park roads only, would result in short- and long-term, negligible to minor adverse impacts. Continued monitoring and adaptive management would allow for additional restrictions to be established should negative impacts on wildlife begin to occur. Cumulative impacts would be long-term minor to major adverse, of which alternative 4 would be a small part.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Displacement of Individuals

Snowmobiles and snowcoaches elicit slightly different intensities and amounts of responses from bison and elk. Based on recent behavioral monitoring data and modeling, it appears that snowmobiles are slightly more likely to elicit a visible behavioral response from bison or elk (vigilance or movement), but that snowcoaches elicit slightly stronger levels of behavioral responses, such as movement or flight, due to the larger visual profile of these vehicles (Borkowski et al. 2006; McClure et al. 2009; White et al. 2008). Increased OSV group size also has been found to increase response, but group size in snowcoaches reached a maximum effect at three snowcoaches, after which there was no increase (White et al. 2008). Individual bison and elk may still be locally displaced if access is limited to snowcoach only, as would occur under alternative 5 if snowmobiles were completely phased out, but impacts would likely be small and localized. Alternative 5, when initially implemented, would

Snowmobiles and snowcoaches differ in size, noise levels, size of groups, and amount of group activity. They therefore elicit slightly different intensity and amount of responses from bison and elk. Based on recent behavioral monitoring data and modeling, it appears that snowmobiles are slightly more likely to elicit any visible behavioral response from bison or elk (vigilance or movement), but that snowcoaches elicit slightly stronger levels of behavioral responses, such as movement or flight, due to the larger visual profile of these vehicles. Use of snowcoaches can reduce the total number of OSVs in the park on a daily basis, but have a slightly higher likelihood of initiating a movement response by bison and elk.

have OSV use levels (up to 318 snowmobiles and 78 snowcoaches) similar to those currently permitted and impacts during this time would be the same as alternative 2.

Based on user demand, starting after the winter 2015 season, a five-year phase out could occur and could result in use levels of 120 snowcoaches and no snowmobiles, which would represent a reduction in the total number of OSVs in the park on a daily basis compared to current conditions. Because the transition to snowcoaches would be based on user demand, or at the discretion of the Superintendent, this alternative could also result in continuation of current use levels of up to 318 snowmobiles and 78 snowcoaches per day, resulting in the same short-term minor impacts as those under alternative 2. Therefore, despite the potential for an increase in the total number of snowcoaches under alternative 5, the total number of vehicles in the park could decrease, which would limit the duration of encounters between OSVs and bison or elk, and with BAT requirements, would also reduce the total time the animals are exposed to OSV related sounds. Although snowcoaches have a slightly higher likelihood of initiating a movement response by bison and elk, the total number of OSV groups would be similar to that occurring under current conditions. Therefore, impacts under alternative 5 are predicted to be localized, short-term minor to moderate adverse. These impacts would similar to those occurring under alternative 2. This is because it is unclear whether the phase-out of snowmobiles would occur. If the transition to slowcoaches only does happen, OSV group numbers would be similar to those under alternative 2, likely resulting in similar movement and associated displacement effects.

Behavioral and Physiological Responses

Behavioral and physiological responses by individual bison and elk would still occur under alternative 5, but such effects are predicted to be long-term minor adverse. This is because, until the phase out occurs, the frequency of encounters between OSVs and would be the same as alternative 2. Should a complete phase-out occur, the number of snowmobile groups and individual OSVs would be similar. If the phase out does not occur, minor impacts would continue at the same level as under alternative 2. Based on recent behavioral monitoring data and modeling, it appears that snowmobiles are slightly more likely to elicit a visible behavioral response from bison or elk but snowcoaches elicit slightly stronger levels of behavioral responses, such as movement or flight (Borkowski et al. 2006; McClure et al. 2009; White et al. 2008). Recent behavioral observations found that bison and elk demonstrate a movement response during 8% to 9% of encounters with snowcoaches (Borkowski et al. 2006; White et al. 2008), which may result in minor to moderate energy costs. However, no adverse population-level effects would be expected because there have been no observed impacts on population growth or demographics correlating to increased or decreased OSV use in the park over the last 38 years. Behavioral responses and associated physiological effects resulting from exposure to human disturbance would result in localized, short-term minor adverse impacts.

Population-level Impacts

No short-term population-level effects from OSV use have been observed for bison and elk historically, including when an average of 795 snowmobiles and 15 snowcoaches entered the park daily (greater than the level proposed under alternative 5) (Fuller 2006; White et al. 2008). Simulation indicates that long-term population-level impacts could occur due to the presence of groomed roads (Coughenour 2005). But most researchers have concluded that bison population growth is based primarily on the cessation of active management and culling of the park's bison population, rather than any energetic savings and associated increased survival from travel on groomed OSV routes (Bjornlie and Garrott 2001; Gates et al. 2005; Bruggeman et al. 2009a; Plumb et al. 2009; White et al. 2008). Behavioral response monitoring indicates movement responses in 8% to 9% of bison and elk observed, and these active travel and flight behaviors may result in small scale displacement and increased energy expenditure. There has been no data indicating that these responses have resulted in observable impacts on population, but impacts to individuals that eventually lead to population-level impacts may occur over time, or with especially harsh winters. Population-level impacts are predicted to be long-term minor adverse under alternative 5, because of the long-term impacts that could occur due to behavioral responses, potentially resulting in small-scale displacement that may lead to observable impacts on the population.

Cumulative Impacts

Impacts on bison and elk from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The major impacts stated are a result of bison control measures and management under the IBMP, which is unrelated to winter use in the park. These long-term negligible to major adverse impacts, when combined with the short and long-term minor adverse impacts of alternative 5 would result in long-term minor to major adverse cumulative impacts. Alternative 5 would contribute little to the cumulative impacts on bison and elk due to low OSV numbers.

Conclusion

The existing data suggest that the higher visual profile of a snowcoach may elicit stronger bison and elk behavioral responses than snowmobiles. Thus, restricting OSVs to just snowcoaches would not eliminate adverse effects on wildlife. However, the available literature on bison and elk indicate that lower OSV numbers and associated recreation reduce vehicle-caused mortality, wildlife displacement, behavior or physiology-related energy costs, and the potential for adverse demographic impacts, resulting in short and long-term minor adverse impacts. Cumulative impacts on bison and elk under alternative 5 would be long-term minor to major adverse, to which alternative 5 would contribute a small amount.

Impacts of Alternative 6: Implement Variable Management

Displacement of Individuals

In general, impacts related to displacement of individuals would be similar to those under alternatives 2 and 3, with use levels under alternative 6 ranging from zero to 540 snowmobiles per day and zero to 78 snowcoaches per day over the season; therefore, impacts would be long-term minor to moderate adverse. However, alternative 6 also would include an element that would allow for up to 25% of the snowmobile use to be unguided or non-commercially guided. Guided groups are much more likely to pass bison and other animals that are on or near park roadways with a minimum of wildlife reaction or harassment. Non-commercial guides and unguided users would be required to go through some level of training, which would include instruction on how to avoid harassing animals in the park. In 2001, several seasons before guiding started, nearly 60% of encounters between OSVs and bison on roads resulted in negative behavioral responses by bison, including OSV-hastened movement of bison along long stretches of road or bison being pushed off the road and into the snow (Borkowski et al. 2006; Aune 1981). This same season, Hardy found that elk were displaced about 60 meters from heavily traveled OSV routes, including the Madison to Old Faithful road segment, because the number of total OSVs increased over the course of a winter (Hardy 2001). The displacement of elk and movement behaviors by bison in response to snowmobiles were observed in 2001 when a total of 69,156 OSVs entered the park, which is nearly double the annual limit of 32,000 snowmobiles and 4,600 snowcoaches (totaling 36,600 OSVs) proposed in alternative 6. Although alternative 6 would allow up to 25% of snowmobiles entering the park to be unguided or non-commercially guided, the number of unguided or non-commercially guided snowmobiles would be much lower than those entering the park from 1999 to 2003. Between 1999 and 2003 there were no implemented guiding requirements and daily entrance numbers were frequently above the maximum 540 per day proposed under alternative 6 (daily average of 795 snowmobiles and 15 snowcoaches). However, although the numbers of OSVs allowed in the park daily under alternative 6 (up to 540 snowmobiles and 78 snowcoaches) are lower than the historical high of 795, there would be a higher potential for direct harassment of bison and elk due to the allowance for 25% of unguided or non-commercially guided snowmobiles. Alternative 6 would allow up to 135 unguided/non-commercially guided snowmobiles per day and 8,000 total unguided/non-commercially guided snowmobiles per year. Training of unguided/non-commercially guided users, if effective, would minimize behaviors by unguided users that result in energetically costly behaviors by wildlife. Despite training, it is more likely that unguided/non-commercially guided users would be less familiar with park roads, probable locations of wildlife, and wildlife behavior, increasing the potential for wildlife behavioral responses to these users. Additionally, unguided/non-commercially guided users are likely to travel in a more random fashion throughout the day, without the morning/evening peaks observed for guided users. This may limit the potential for wildlife habituation to OSVs.

Under alternative 6, group size limits would be 22 snowmobiles per group rather than the 11 snowmobiles per group limit currently implemented. This would increase the likelihood of bison or elk showing strong behavioral responses, because behavioral studies indicate that bison or elk are much more likely to demonstrate vigilant or movement responses with large snowmobile group size, with longer interaction times (interaction times would also increase with group size, as a result of the longer amount of time it would take for twice as many snowmobiles to get out of visual and auditory range of bison or elk), when snowmobilers directly approach bison or elk, especially if the animals are on the roads, and with smaller bison or elk group size (Borkowski et al. 2006; White et al. 2008). Fewer daily groups may offset the effects of larger group size; however, the exact cause-effect relationship is difficult to determine. Data demonstrates the likelihood of a response to OSV disturbance also increased with cumulative OSV use in the park for elk, whereas the likelihood of a response decreased for bison with cumulative OSV use. Also, the likelihood of a movement response by elk increased for each additional snowmobile in a group past 3 snowmobiles, whereas the likelihood of a movement response by bison increased with each additional snowmobile in a group up to a limit of 7 to 18 snowmobiles (White et al. 2006). Therefore, the overall impacts of this alternative would likely increase behavioral responses, despite possible benefits associated with fewer snowmobile groups.

Commercial guiding involves use of a paid guide as part of a commercial tour; such tours are permitted by the park. "Non-commercial guided" tours means that the tour is a private group under the direction of a selected guide who is responsible for his/her group. "Unguided" means any individual or group of individuals that has no one responsible party acting as a tour guide. Annual monitoring data and historical records indicate that direct harassment of wildlife is more likely to occur from unguided snowmobile users.

Non-commercial guides and unguided users would receive training on how to avoid harassing animals in the park. This training, if effective, would minimize behaviors by unguided users that result in energetically costly behaviors by wildlife. Despite training, it is more likely that unguided/non-commercially guided users would be less familiar with park roads, probable locations of wildlife, and wildlife behavior, and may travel in a less predictable pattern, thereby increasing the potential for wildlife behavioral responses to these users.

Other factors also increase the risk of displacement or movement responses by individuals by contributing to a reduced potential for wildlife habituation under this alternative. Not only would OSV use occur in a less regular pattern than with guided OSV use, unguided/non-commercially guided OSV drivers likely show less predictable behavior during interaction with wildlife than drivers with a guided group. Unguided/non-commercially guided users would also have less overall education of the park and the wildlife than commercial guides, which may inadvertently lead to more behaviors that result in harassment. Additional variation would also result from the daily variance in entrance numbers (from 0 to 540 snowmobiles and from 0 to 78 snowcoaches) and would increase the unpredictability of OSV traffic on a day-to-day, and not just an hour-to-hour, basis. Wildlife habituate best to a disturbance when disturbances are regular in time, space, and duration, and when the disturbance itself occurs in a predictable manner (e.g., not stopping when encountering bison off road, or stopping more than 500 meters away when bison are on the road) (Gill et al. 2001). Therefore, bison and elk are less likely to habituate under this alternative, and thus may show more frequent and more intense behavioral responses to OSV traffic (White et al. 2008).

However, the core range of bison and elk has not changed over the past 38 years, despite periods of unguided OSV use at daily averages and yearly totals of OSVs well above (about double) those proposed under alternative 6. Despite the increase in potential displacement, individual bison and elk would likely demonstrate temporary, short-term displacement, with longer-term displacement possible in certain habitats (e.g., thermal, wet meadow), under certain winter conditions (e.g., exceptionally heavy snowpack and cold), and with higher pressure from OSV users (higher daily numbers, as the number of total OSVs increases over the course of a winter season) (Bruggeman et al. 2006; White et al. 2008). Therefore, the impacts of displacement under alternative 6 would be localized, short-term moderate adverse because frequent or stronger movement responses by bison or elk and/or temporary displacement from prime foraging areas could lead to an increased negative energy balance for these animals. Small energy imbalances could, over the course of many seasons, affect individual animal survival and reproductive success.

Behavioral and Physiological Responses

Under alternative 6, several factors would increase the potential for increased behavioral and associated physiological responses by bison and elk. Variable daily limits (0 to 540 snowmobiles and 0 to 78 snowcoaches) would result in OSV use that would be less predictable, as described above. Bison and elk in Yellowstone show some degree of habituation to OSV use, and habituation increases when disturbance occurs in a regular pattern (Borkowski et al. 2006; White et al. 2008). Allowing unguided/non-commercially guided snowmobile users in the park could increase the potential for snowmobile drivers to engage in activities such as directly approaching animals or riding off road (Aune 1981; Borkowski et al. 2006). Such behavior would both contribute to reduced habituation and directly increase the potential for a negative behavioral response and/or increased physiological stress and energy expenditures (White et al. 2008). Finally, this alternative would allow larger group sizes—up to 22 snowmobiles per group. Behavioral studies have indicated that larger group sizes elicit stronger behavioral responses from bison and elk (Borkowski et al. 2006; White et al. 2008). Taken together, these factors would increase the potential for adverse impacts on bison and elk behavioral and physiological responses. Therefore, the impacts on behavioral and physiological responses under alternative 6 are predicted to be localized, short-term minor to moderate adverse because of decreased bison and elk habituation, and increased potential for frequently occurring, high-level behavioral responses by bison and elk due to variable use limits, group size increases to 22, and the 25% unguided/non-commercially guided provision for snowmobiles.

Population-level Impacts

Population-level impacts would be long-term minor to moderate adverse under alternative 6 because of the potential for short- or long-term displacement, and higher-level, more frequent behavioral and physiological responses by bison and elk, as described above. No population-level effects from OSV use have been observed for bison and elk during annual behavioral monitoring from winter 1999 to winter 2009. This was true even when an average of 795 snowmobiles and 15 snowcoaches entered the park daily, which is slightly higher than the maximum total number of OSVs allowed in the park under alternative 6 (810 OSV daily average compared to 618 OSV daily limit under alternative 6). Also, no population-level impacts were observed prior to use limits, when peak days were up to 1,457 snowmobiles and 35 snowcoaches per day. However, over the long-term, the daily entrance levels under alternative 6, and variable entrance provisions, combined with the decreased habituation potential and possible impacts of unguided/non-commercially guided users, may result in small-scale impacts on demographics, reproduction, and survival (Fuller 2006; White et al. 2008). These impacts are especially likely during harsh winters, when elk and bison are in more energetically stressed due to decreased food intake and increased energy demands because of cold and snow conditions, and more susceptible to the relatively small energy costs associated with increased vigilance, movement, or displacement due to OSVs.

Cumulative Effects

Impacts on bison and elk from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The major impacts stated are a result of bison control measures and management under the IBMP, which is unrelated to winter use in the park. These long-term negligible to major adverse impacts, combined with the short and long-term minor to moderate adverse impacts of alternative 6 would result in long-term minor to major adverse cumulative impacts. Alternative 6 would contribute a noticeable amount to cumulative impacts because of the unguided/non-commercially guided provision, variable daily OSV numbers, and high use limits.

Conclusion

The variable number of OSVs allowed per day under this alternative would likely increase the behavioral responses of bison and elk due to daily unpredictability and reduced potential for habituation. These increased responses are due in part to the larger snowmobile group sizes (22 individual vehicles rather than 11) allowed under this alternative, which have been found to increase the probability of strong behavioral and associated physiological responses, leading to possible displacement of bison and elk and resulting in long-term moderate adverse impacts. Additionally, the unguided/non-commercially guided provision, variable daily OSV numbers, and high use limits may result in decreased habituation and increased behavioral, physiological and displacement responses by bison and elk. Measures under this alternative, including BAT snowmobiles, variable use limits, closing of certain roads to motorized traffic two weeks prior to the end of the season, and setting limits on seasonal numbers of snowmobiles and snowcoaches in the park, would help limit wildlife impacts. Impacts under alternative 6 would be long-term minor to moderate adverse, due to unguided provision, variable limits, and increased group size. Cumulative impacts on bison and elk under alternative 6 would be long-term minor to major adverse, to which alternative 6 would contribute a noticeable amount.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Displacement of Individuals

The maximum daily level of OSV use under alternative 7, which would occur for half of the winter season (330 snowmobiles and 80 snowcoaches) would be higher than use levels occurring under recent conditions, with an average of 187 snowmobiles and 31 snowcoaches per day, and peak use of up to 293 snowmobiles and 59 snowcoaches per day during winter 2010. Based on observations from winter seasons when similar numbers of OSVs to those proposed under alternative 7 entered the park (winter 2004 to winter 2009 when daily OSV entrance numbers were on average 258 snowmobiles and

30 snowcoaches per day, with peaks of 488 snowmobiles and 55 snowcoaches per day), researchers have not observed any long-term displacement of individual bison or elk. Researchers have not observed long-term displacement of bison or elk during winter seasons with higher levels of use prior to winter 2004 (peaks of 1,457 snowmobiles and 35 snowcoaches per day and averages of 765 snowmobiles and 15 snowcoaches per day); nor was any long-term displacement attributed to OSV use in the park from 1969 to the present. Over the past three and a half decades, OSV use numbers have fluctuated dramatically from winter to winter, and bison and elk have continued to use the same core winter range (Craighead et al. 1973; Aune 1981; Hardy 2001). Thus, range-wide displacement of bison or elk would be unlikely under alternative 7 because conditions similar to or with lower OSV use than that occurring under recent conditions would continue (under which conditions displacement has not been observed). Half of the winter season would have lower use levels than those occurring under recent conditions, with daily entrance limits of up to 220 snowmobiles and 50 snowcoaches for one third of the season and up to 132 snowmobiles and 30 snowcoaches for one-sixth of the winter season. There would be fewer interactions between OSVs and bison and elk would be reduced during periods of lower OSV entrance numbers, reducing the potential for high level behavioral responses leading to displacement. Side roads would be closed, and the east entrance road would be close two weeks prior to the end of the winter season, limiting disturbance to individuals in these areas.

Despite no observed large-scale shifts in habitat use due to the presence of OSVs in the park, both bison and elk have demonstrated flight from OSVs or avoidance of OSV use areas, resulting in small-scale and temporary shifts in habitat use by bison and elk (White et al. 2008). Although these displacement events are brief and temporary, if they occur frequently over the course of a winter this may decrease both the amount of time elk, and to a lesser extent bison, have to feed, and may also increase energy demands due to movement. Because elk and bison generally suffer a decline in body condition associated with increased energy demands and poorer forage quality over the course of a winter, these factors may further contribute to this energy imbalance. As a result, individual bison and elk that frequently avoid OSV use may demonstrate poorer body condition. However, despite short-term responses to OSVs, overall habitat use by bison and elk does not appear to be affected by exposure to OSVs and associated movement or alert responses (Hardy 2001; White et al. 2008). Researchers attribute changes in distribution of elk during the winter primarily to snow mass and heterogeneity (Messer 2003). Researchers attribute bison distribution primarily to population density, snow characteristics, drought, and other factors affecting resource availability (Bruggeman et al. 2006).

Thus, displacement impacts to individual bison and elk under alternative 7 would be localized, short-term moderate adverse. Although displacement events may be brief and temporary, over the course of a winter this may reduce energy consumption by elk, and to a lesser extent, bison, potentially resulting in poorer body condition.

Behavioral and Physiological Responses

Under all action alternatives, trained guides would maintain buffer zones and instruct visitors to behave in a manner that minimizes the likelihood of a strong, energetically costly behavioral response by bison or elk (White et al. 2008). Under recent managed use, guiding has resulted in defined morning and evening peaks in OSV traffic, which may cause increased behavioral responses by ungulates during this time due to more concentrated OSV use. Under alternative 7, the provision that all OSV traffic must enter the park by 10:30 a.m. would further concentrate this pulse of OSV use in the park, specifically along high use corridors such as the Madison to Old Faithful road segment, where bison and elk are frequently encountered (McClure et al. 2009). Borkowski et al. (2006) found that the likelihood of eliciting a movement response from elk increased by 1.1 times with each additional snowmobile added to a group with no threshold, whereas the likelihood of eliciting a movement response by bison increased by 1.1 times with each additional snowmobile up to a threshold of 7 to 18 snowmobiles. This indicates the importance snowmobile group size has on the likelihood of eliciting behavioral responses by both bison and elk. Borkowski et al. 2006; White et al. 2006; White et al. 2008). Snowmobile group size would be limited to a maximum of 11 under alternative 7, but frequent encounters with OSV groups during periods of intense OSV use may have similar impacts on bison and elk similar to increased group size.

A predictable daily pattern of OSV use would be more likely to decrease overall behavioral responses by bison and elk throughout the winter. This is because animals are more likely to become habituated to a disturbance if it is predictable in time and space, not directly harmful, and limited in duration (Thompson and Henderson 1998; White et al. 2008). Depending on the frequency of OSV encounters, active responses by bison and elk (which based on studies would occur during 8% to 9% of encounters (Borkowski et al. 2006; White et al. 2008)) may result in minor or moderate energy costs.

High-level behavioral responses are also possible due to potential OSV intensive periods resulting from a combination of flexible daily use limits and the 10:30 a.m. cutoff for OSV entrance to the park. Flexible scheduling of daily entrance numbers reduces the total number of OSVs in the park on the annual scale; however, with regard to actual use numbers in the park, flexible scheduling may have little impact. This is because flexible scheduling of higher and lower daily use limits would allow for holidays, or periods of higher demand to be filled to the highest use levels, whereas periods of lower demand would not be filled due to natural lower visitor demand, according to actual use levels from 2004 to 2010. This could potentially result in blocks of high use, and blocks of low use, because of higher and lower use limits. When combined with the 10:30 a.m. entrance cut-off, OSV use may be compacted into a short time period along routes, such as Madison to Old Faithful, where OSV and bison or elk encounters are common. The likelihood of both species demonstrating a heightened behavioral response increases with larger OSV group size, shorter distance between wildlife and OSVs, smaller bison or elk group size, direct approach or harassment by winter visitors, increased interaction time between OSV groups and bison or elk, and the visual profile of the vehicle (Borkowski et al. 2006; White et al. 2006; White et al. 2008). Even with group size limits, frequent encounters with OSVs may increase the likelihood of a heightened behavioral response, because closely spaced OSV groups may have similar effects to those of larger OSV group size and longer interaction time between OSVs and wildlife.

Any increase in actual OSV numbers entering the park, up to the proposed daily limits, would likely increase bison and elk behavioral and physiological responses beyond those observed in winter 2009. Based on behavioral observation from winters that had similar levels of use to those proposed under alternative 7 (winters 2006 to 2009), impacts to bison and elk resulting from continued OSV levels are predicted to be localized, short-term minor adverse under alternative 7.

Population-level Impacts

Historically, researchers have not observed population-level impacts on bison and elk under periods of un-guided travel, and higher daily numbers of OSVs in the park. No adverse population-level impacts are expected, because there have been no observed impacts on population growth or demographics correlating to increased or decreased OSV use in the park over the last 38 years. This includes the winters from 2004 to 2009, when daily entrance numbers for snowmobiles (258 snowmobiles and 30 snowcoaches daily average, peak use of up to 488 snowmobiles and 55 snowcoaches per day) were similar to those proposed under alternative 7. Daily limits of up to 318 snowmobiles and 78 snowcoaches were not met in winter 2010 after implementation of the 2009 interim rule, with actual averages of 187 snowmobiles and 32 snowcoaches per day. Wildlife behavioral monitoring prior to 2004 also observed no short-term population-level effects from OSV use for bison and elk, including when an average of 795 snowmobiles and 15 snowcoaches entered the park daily (Fuller 2006; White et al. 2008). Long-term impacts on population could occur under alternative 7 because of the small-scale displacement, reduced forage intake, and increased energy expenditure resulting from behavioral responses. Over time these lead to observable impacts on the population, but such impacts have not been observed under historical levels of use. Population-level impacts are predicted to be long-term minor adverse under alternative 7.

Cumulative Impacts

Impacts on bison and elk from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The major impacts stated are a result of bison control measures and management under the IBMP, which is unrelated to winter use in the park. The long-term negligible to major adverse effects of these actions, when combined with the long-term minor to moderate adverse impacts of alternative 7, would result in long-term minor to major adverse cumulative impacts on these species. Alternative 7 would contribute a little to the overall adverse cumulative impacts on bison and elk.

Conclusion

Alternative 7 would allow use levels similar to the 2009 interim rule, with BAT requirements, guiding regulations, speed limits, and restrictions on OSV access to park roads only. Variable use levels allow for continued monitoring and adaptive management to establish additional restrictions to be established should negative impacts on wildlife begin to occur. Thus, overall impacts under alternative 7 would be short- and long-term minor to moderate adverse. Cumulative impacts would be long-term minor to major adverse, to which alternative 7 would contribute a small amount.

LYNX AND WOLVERINES

Lynx and wolverines use similar habitat in Yellowstone and are primarily found in the eastern sector of the park, crossed by the east entrance road, and containing Sylvan Pass. Both species are highly mobile, with large home ranges and the ability to travel great distances in a day. Lynx and wolverines are rare in the greater Yellowstone area and their populations are limited to sparsely distributed mountainous or wooded habitat, so that the persistence of the species in an area may be dependent on genetic dispersal. Both species generally avoid areas of heavy human use, and are rarely observed by park researchers or visitors. Canada lynx in the lower 48 states were listed as threatened under the ESA in March 2000 (USFWS 2000).

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Displacement, Behavioral, and Physiological Effects

Though a few visitors may travel into the park by non-motorized means during the winter, it is unlikely that a large number of visitors would penetrate the backcountry and mountainous areas preferred by lynx and wolverines (due to the distance that would need to be covered by a skier or snowshoer in a harsh winter environment). Under alternative 1, non-motorized use at the east entrance (Sylvan Pass), where lynx are known to occur, would not be expected because this area is an avalanche zone and with Sylvan Pass closed, avalanche mitigation activities would not occur. It is also unlikely that visitors would encounter roaming lynx or wolverines anywhere else in the park due to the animals' scarcity, elusiveness, and propensity for night or dusk travel, when humans are generally not active in the park. Therefore, impacts from displacement would be localized, short-term negligible adverse, under alternative 1, whereas behavioral and physiological effects would be extremely rare and negligible with long-term beneficial impacts due to the elimination of human presence.

Population-level Effects

Under this alternative there would be no population-level effects, due to a nearly complete lack of interaction or encounters between winter users and lynx or wolverines, resulting in long-term negligible adverse impacts.

Cumulative Effects

Wolverines are still trapped in parts of the greater Yellowstone area, and such harvest may result in mortality of critical members of the population, limiting reproduction, genetic dispersal, and long-term viability of the species in the area. Although only a few individuals are trapped each year, the small population of wolverines may suffer long-term, moderate, adverse impacts from trapping activities (Squires et al. 2007).

Several of the forests in the region are revising their forest plans and/or travel plans, including the Gallatin National Forest Travel Plan Revision, and the Beartooth Custer National Forest Travel Management Plan. Actions associated with these plans could affect lynx and wolverines. The federal and state wildlife management agencies are required to ensure the long-term viability of lynx (for the forests, pursuant to the Northern Rockies lynx amendment to all USFS forest plans). Impacts to lynx as a result of implementation of the Northern Rockies lynx amendment to USFS plans would be long-term beneficial. Also, the USFWS has initiated a status review of the wolverine to determine whether the species warrants protection under the ESA and is currently in the process of gathering information. This should help further determine cumulative effects on the elusive and rarely studied wolverine. If the status review results in listing of wolverines as threatened or endangered, long-term beneficial impacts would occur from implementation of measures to ensure the long-term viability of this species in the greater Yellowstone area.

The Gallatin National Forest has recently consolidated much of its checkerboard public and private land holdings, accompanied by the consolidation of private lands, particularly in the Big Sky area. This means there are larger tracts of public land that are less likely to be developed, but also large areas of private lands that are more likely to be developed. Many of the private lands are in relatively high altitude areas (in contrast to other areas of rapid subdivision and growth in greater Yellowstone area), and may once have been, or could be, important range for wolverines and lynx. Impacts from this consolidation would be long-term minor to moderate adverse, because development changes the landscape forever, eliminating habitat for existing lynx or wolverines using these areas and for any future lynx or wolverines dispersing into these areas.

Road construction is a recurring event in the park, including recent projects at the east entrance and Madison to Norris roads. Any activities in the park are undertaken in such a way as to minimize adverse effects on wildlife and wildlife habitat; this is also true for projects in the national forests, as required by the Northern Rockies Lynx Amendment to all USFS plans. For example, most facility construction projects in parks and forests take place at previously disturbed sites and replace existing structures, minimizing new effects on wildlife. The east entrance project within the park involved only minimal realignment of existing roadways. The Madison to Norris construction moved the road about half a mile from its original location, for a distance of about two miles, and restored two miles of road adjacent to the Gibbon River. Impacts on wolverines and lynx from road construction in the park would be long-term negligible adverse, but would range from long-term minor to moderate adverse in the greater Yellowstone area. This is because lynx tend to limit their movements around roads and are prone to road kill mortality. Wolverines also avoid human activity, including roads, and may adjust their dispersal and movements where roads cross their territory (Banci 1994; Copeland 1996; Hornocker and Hash 1981). Additionally, road improvements in critical areas of wolverine or lynx habitat, such as mountain passes, could limit the animals' movements because roads in mountainous areas often occur in natural travel routes where the terrain is less demanding. Because so little is known about how wolverines travel across the landscape, it is difficult to determine the impacts of roads on this species.

Separately or combined, the actions discussed above would result in an increase or decrease in the population of prey/carcass availability for wolverines and lynx, on an available habitat, which would affect wolverine and lynx habitat use and population in these areas, and in the entire greater Yellowstone area. Impacts of reduced prey or carcass availability would result in minor to major impacts on lynx, and minor impacts on wolverines, because lynx are more susceptible to starvation mortality.

The long-term minor to major adverse impacts of these past, present, and reasonably foreseeable future actions, combined with the short- and long-term negligible adverse impacts of alternative 1, would result in long-term minor to major adverse cumulative impacts on lynx and wolverines. Alternative 1 would contribute minimally, if at all, to cumulative impacts because there would be no visitor OSVs in the park.

Conclusion

Alternative 1 would result in short- and long-term negligible adverse impacts on lynx and wolverines in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts, with long-term beneficial impacts from the removal of human presence. Cumulative impacts of alternative 1 would be long-term minor to major adverse, of which alternative 1 would contribute minimally.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Displacement, Behavioral, and Physiological Effects

Alternative 2 would continue road grooming and management of Sylvan Pass, the closest OSV route to prime lynx and wolverine habitat in the eastern sector of the park. Wolverine females give birth to young in mid-February, during peak OSV season, where one natal den was found at Sylvan Pass in 2009. Because denning females are likely sensitive to human disturbance (Myrberget 1968; Pullianian 1968), OSV use and maintenance activities (particularly avalanche control methods) may cause wolverines using the area to leave, and/or cause females to abandon their dens for poorer den sites, increasing kit mortality and decreasing the reproductive success of wolverines. Also, groomed roads in other areas of the park may limit critical dispersal and movements of wolverines between the high-elevation alpine habitats that make up their range. Wolverines and lynx in Yellowstone are on the southern tip of their range in North America, and suitable habitat for both species in the greater Yellowstone area occur in patches, separated by poor habitat (Brock et al. 2007). There have been documented movements of a dispersing, Global Positioning System (GPS) collared wolverine across the central range of Yellowstone, indicating that disturbance in any area of the park could impact dispersal and movements of wolverines if disturbances occur outside of areas of ideal habitat for either species (Wildlife Conservation Society 2007).

Behavioral and associated physiological effects associated with OSV use have never been specifically investigated for these species. However, observations of habitat use indicate that wolverines avoid areas of human activity, including snowmobile routes (Banci 1994). Studies conducted on the Rocky Mountain lynx populations have found that lynx may avoid crossing highways, avoid areas of human presence, and use roads as territory boundaries (Apps 1999). Lynx do not appear to avoid crossing logging roads or roads with lower levels of vehicle use (Koehler and Brittel 1990; McKelvey et al. 1999). Mowat et al. (1999), who studied lynx in Canada where habitat is generally less fragmented than lynx habitat in the lower 48 states, observed that lynx appeared to tolerate moderate levels of snowmobile traffic, readily crossed highways, and established home ranges in proximity to roads. Under alternative 2, an average of 5 OSV groups would be expected to travel through the pass daily (up to 22 OSVs per day). Avalanche control work has been ongoing in Sylvan Pass since 1973 and includes the use of explosives. Researchers do not know whether the recently located wolverine den site at Sylvan Pass is new, or if the den site has persisted for years despite avalanche control activities and OSV use in the area. Impacts to lynx and wolverines under this alternative are predicted to be localized, short-term minor adverse because disturbance from OSVs on the Sylvan Pass road and maintenance activities could adversely impact reproductive success of denning wolverine females. Depending on how far these species travel outside the eastern section of the park, where use would be more limited, impacts have the potential to be moderate adverse, because groomed OSV roads in other areas of the park could and limit movements and dispersal of both species. Specific behavioral and physiological effects are unknown, because habituation by lynx or wolverine to the levels of OSV use that would occur in Yellowstone under alternative 2 has never been observed. However, it is likely that increased human disturbance would result in higher rates of flight or avoidance by wolverines and lynx. Additionally, associated physiological responses would also likely be increased in these species, with exposure to OSVs. Physiological responses generally result in increased energy expenditure and during the severe winter months such responses may result in a critical energy imbalance.

Population-level Effects

The two recent sightings of lynx in the north-central section of the park, along the popular Norris Geyser Basin to Mammoth Hot Springs route, support the possibility that lynx may travel or may be found outside of the park’s east sector. Additionally, radio collar tracking indicates that wolverines may travel up to 50 miles in a 17-hour period, and travel through non-preferred habitat, including the central portion of Yellowstone (Inman et al. 2007a). These travels may result in fairly regular encounters between OSVs or groomed roads and these animals, even if lynx and wolverines are rarely seen by winter users due to their keen senses and general avoidance of human activity. Additionally, road density and associated human activity is proposed as one of the driving factors behind the extirpation of wolverines from formerly occupied wolverine habitat in California, Oregon, and Washington (Ruediger et al. 2000). Impacts to highly mobile lynx and wolverines due to groomed roads and human activity would be long-term, minor adverse, because groomed roads and OSV presence under alternative 2 may disrupt their winter movements.

Wolverines reproduce at slow rates, with females reaching reproductive maturity at about 3 years of age. Wolverines birth only one kit an average of every 2.3 years (Inman et al. 2007b) and female reproductive success is critical to ensuring the long-term viability of the species in the area. Under this alternative Sylvan Pass would remain open, and because wolverine females give birth in mid-February, with at least one known den in Sylvan Pass, there is a risk of increased kit mortality and lower quality parental care by female wolverines if they are disturbed by OSVs and Sylvan Pass maintenance activities (Pullianian 1968). Impacts to wolverine reproductive success would be long-term, minor adverse.

Impacts to lynx may be long-term minor adverse effects because their mating season overlaps OSV use in the park by about 2 weeks, and roaming lynx may be limited by groomed OSV use and disturbance (Copeland 1996; Mowat and Slough 1998). As discussed under “Displacement, Behavioral, and Physiological Effects" above, lynx appear to be able to adapt to moderate levels of snowmobile use and human disturbance. The east entrance levels of 20 snowmobiles and 2 snowcoaches per day, resulting in about 5 OSV groups/day proposed under alternative 2 would keep snowmobile traffic in the area at low levels.

Population-level impacts on lynx and wolverines under alternative 2 are predicted to be long-term minor adverse because lynx or wolverines may avoid areas of OSV use, or may limit their range and associated genetic dispersal due to the presence of groomed roads, in the park, due to their large home range size and the importance of travel between patchy habitat. These responses to OSV use areas could ultimately result in population-level impacts on the relatively slow reproducing lynx and wolverines.

Overall, these impacts would be mitigated under this alternative through monitoring and closures of areas if deemed necessary. Monitoring of human-wildlife interactions would continue under all alternatives. If NPS monitoring indicates that human presence or activities have unacceptable effects on lynx or wolverines that cannot be otherwise mitigated, selected areas of the park (including sections of roads) may be closed to visitor use. However, it is difficult to determine lynx or wolverine population numbers in Yellowstone, and lynx and wolverines are rarely observed by researchers. Therefore, NPS monitoring would require intensive surveys to determine any effects from OSVs on lynx or wolverines, due to the species' scarcity and their propensity to inhabit steep, mountainous areas of the park, limiting the effectiveness of this mitigation measure. The park has the authority to close areas of the park for wildlife protection; for example, to prevent disturbance of denning wolverines. If a wolverine or lynx den is found in an area of the park near human activity, where disturbance is likely, the superintendent could implement closures.

Cumulative Effects

Impacts on lynx and wolverines from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor to major adverse effects of these actions, when combined with the short- and long-term minor adverse impacts to potentially long-term moderate adverse impacts of alternative 2, would result in short- and long-term minor to major adverse cumulative impacts on these species. Alternative 2 would contribute a minimal amount to cumulative impacts, primarily due to continued OSV use in the park and at Sylvan Pass.

Conclusion

This alternative would maintain and allow OSV use at Sylvan Pass, the area of the park where human-wolverine interactions would be most likely to occur. However, daily entrance limits restrict the east entrance to just 20 snowmobiles and two snowcoaches per day, (five groups of OSVs), resulting in little use in this area, and minimal disturbance to wolverines. Restrictions on movements of lynx or wolverines during the winter months due to the presence and use of OSV routes in other areas of the park may limit reproductive success, dispersal, and overall genetic sustainability of the species, but such impacts are difficult to predict. Therefore, impacts predicted under this alternative would be long-term minor adverse, with the potential for moderate adverse impacts if lynx and wolverines travel outside the eastern area of the park. Cumulative impacts to lynx and wolverines under alternative 2 would be long-term minor to major adverse, of which alternative 2 would contribute a minimal amount.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Displacement, Behavioral, and Physiological Effects

Alternative 3 would continue road grooming and management of Sylvan Pass (as described under alternative 2) and would also allow daily use limits of up to 720 snowmobiles and 78 snowcoaches per day. There is little to no data indicating what, if any, displacement, behavioral, and physiological effects historically higher levels of OSV use (daily averages of snowmobiles up to 950 per day) have on lynx and wolverines in Yellowstone; however, both species generally avoid areas of human activity (Mowat et al. 1999; Banci 1987). The high levels of OSV use limits under alternative 3 would increase the frequency with which wolverines or lynx traveling outside of the park's east sector may be exposed to human use because more OSVs means that OSVs would be heard and seen for longer periods of time. However, alternative 3 would allow for only 20 snowmobiles and 2 snowcoaches at the east entrance, meaning impacts to any wolverine females denning in Sylvan Pass or lynx and wolverines using habitat in the eastern sector of the park would be similar to those under alternatives 2 and 5, with approximately 5 OSV groups traversing the pass each day. These impacts would occur because OSV use and maintenance activities (particularly avalanche control methods) may cause wolverines to leave the Sylvan Pass area, or may cause females to abandon their dens for poorer den sites, increasing kit mortality and decreasing reproductive success of wolverines in the greater Yellowstone area (Myberget 1968; Pullianian 1968). More importantly, groomed roads in the park may limit critical dispersal and movements of wolverine and lynx between the high-elevation alpine habitats that make up their range, primarily due to the limited availability and patchy distribution of quality habitat for both species in the greater Yellowstone area. There have been documented movements of a dispersing, GPS collared wolverine and lynx traveling across the central range of Yellowstone, indicating that disturbance in any area of the park could impact dispersal and movements of wolverines and lynx if disturbances occur outside of areas of ideal habitat for either species (Greater Yellowstone Wolverine Program, Wildlife Conservation Society 2007; Squires and Oakleaf 2005).

Behavioral and associated physiological effects have never been comprehensively observed, but known movements of wolverine and lynx in relation to preferred habitat and human activity provide an estimate of effects. Observations and GPS data on habitat use and movements indicate that wolverines avoid areas of human activity such as snowmobile routes (Banci 1994). Studies conducted on the Rocky Mountain lynx populations have found that lynx may avoid crossing highways, avoid areas of human presence, and use roads as territory boundaries (Apps 1999). Lynx do not appear to avoid crossing logging roads or roads with lower levels of vehicle use (Koehler and Brittel 1990; McKelvey et al. 1999). Mowat et al. (1999), who studied lynx in Canada where habitat is generally less fragmented than lynx habitat in the lower 48 states, observed that lynx appeared to tolerate moderate levels of snowmobile traffic, readily crossed highways, and established home ranges in proximity to roads. Thus, lynx are likely somewhat able to adapt to moderate levels of human disturbance.

Impacts to these two species under alternative 3 would be localized, short-term, moderate adverse, because higher use levels of groomed OSV roads in the park could limit movements and dispersal of both species. It is likely that increased human disturbance would result in higher rates of flight or avoidance by wolverines and lynx, because the relatively high OSV use limits under alternative 3 would likely cross the unknown 'low' disturbance threshold for lynx proposed by Mowat et al. (1999), and the low disturbance threshold for wolverines (Banci 1994), although this exact limit is also unknown. Physiological responses generally result in increased energy expenditures, which may result in a critical energy imbalances during the severe winter months.

Population-level Effects

The two recent sightings of lynx in the north-central section of the park, along the popular Norris Geyser Basin to Mammoth Hot Springs route, support the possibility that lynx may travel or may be found outside of the park's east sector. Additionally, radio collar tracking indicates that wolverines may travel up to 50 miles in less than a 24-hour period, and travel through non-preferred habitat, including the central portion of Yellowstone (Inman et al. 2007a). These travels may result in fairly regular encounters between OSVs or groomed roads and these animals, even if lynx and wolverines are rarely seen by winter users due to the animals' keen senses and general avoidance of human activity. Additionally, road density and associated human activity is proposed as one of the driving factors behind the extirpation of wolverines from formerly occupied wolverine habitat in California, Oregon, and Washington (Ruediger et al. 2000). Therefore, population-level impacts on lynx and wolverine under alternative 3 are predicted to be long-term moderate adverse because the levels of OSV presence proposed in alternative 3 would likely result in more frequent and higher levels of behavioral responses and displacement by lynx and wolverines traveling through the central Yellowstone area. Avoidance of areas of OSV use may also cause lynx or wolverines to limit their movements, decreasing genetic dispersal. Also, OSV use in Sylvan Pass may result in loss of reproductive success for female wolverines denning in the Sylvan Pass area. Both of these factors could ultimately result in population-level impacts on the relatively slow reproducing lynx and wolverine.

Cumulative Effects

The impacts on lynx and wolverines from past, present, and foreseeable future actions under alternative 3 would be the same as those under alternative 1. These long-term minor to major adverse impacts, when combined with the long-term moderate adverse impacts of alternative 3, would result in long-term minor to major adverse cumulative impacts on wolverine and lynx populations in Yellowstone. Alternative 3 would contribute a minimal amount to the overall adverse cumulative impacts due to the high level of OSV use in the park.

Conclusion

This alternative continues to maintain and allow OSV use in Sylvan Pass, the area of the park where human-wolverine interactions are most likely to occur. Restrictions to movements of lynx or wolverines during the winter months due to the presence and high levels of use of OSV routes under alternative 3 (up to 720 snowmobiles and 78 snowcoaches) may also limit reproductive success, dispersal, and overall genetic sustainability of the species due to increased frequency of exposure and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under this alternative would be long-term moderate adverse. Cumulative impacts to lynx and wolverines under alternative 3 would be long-term minor to major adverse, of which alternative 3 would contribute a minimal amount.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Displacement, Behavioral, and Physiological Effects

The closure of Sylvan Pass under alternative 4 and lack of avalanche control activities by the park would virtually eliminate any OSV use in the eastern sector of the park, minimizing human travel through prime lynx and wolverine habitat. Therefore, wolverine females denning in Sylvan Pass would not be adversely affected by OSV use, and in the long term, closure of the area would result in beneficial impacts from the removal of human presence. Groomed roads in the park to allow for OSV use from the south entrance may limit critical dispersal and movements of wolverines between the high-elevation alpine habitats that make up their range, but disturbance would be limited due to the overall lower numbers of motorized vehicles (up to 100 commercially guided wheeled vehicles, 110 snowmobiles, and 30 snowcoaches) in the park, particularly in the park's central sector.

Under alternative 4, the park would plow the roads from West Yellowstone and Mammoth to Old Faithful and allow 100 guided commercial wheeled vehicles per day. This would mean the daily limit of total motorized vehicles in the park would be 240, which is lower than the total number of vehicles allowed currently in the park. Although plowing roads may adversely affect both wolverine and lynx movements, genetic dispersal (e.g., male travels to find a mate and periodically check in on mate and offspring), natal dispersal (the dispersal of the year's young to new home ranges) adult dispersal to more productive habitat, and general use of an area, there would be no additional winter use areas, beyond those currently open. Guided buses would likely have impacts similar to snowcoaches. There have been documented movements of a dispersing, GPS collared wolverine traveling across the central sector of Yellowstone. Also, travelling lynx have been recently sighted in the north-central area of the park, near snow roads. This indicates that disturbance in any area of the park could impact dispersal and movements of lynx and wolverines even if disturbances occur outside of areas of ideal habitat for either species (Greater Yellowstone Wolverine Program, Wildlife Conservation Society 2007). However, the relatively low numbers of motorized vehicles allowed in the park under this alternative would reduce the amount of time that sights and sounds associated with motorized vehicles are present in the park, along with decreasing the frequency with which OSVs are present along the road corridors.

Behavioral and associated physiological effects from OSV use on wolverines and lynx have never been comprehensively observed. Observations of habitat use indicate that wolverines avoid areas of human activity, including snowmobile routes (Banci 1994; Greater Yellowstone Wolverine Annual Report 2008). Lynx appear to be able to adapt to moderate levels of human disturbance (Koehler and Brittel 1990; Mowat et al. 1999). Therefore, impacts to these two species under this alternative are predicted to be localized short-term minor adverse, because there would be no disturbance from OSVs on wolverine denning habitat near the Sylvan Pass road, and there would be less disturbance in the rest of the park because of fewer overall vehicles. The amount of motorized vehicle roads would remain the same, however, and groomed OSV roads in the park could limit movements and dispersal of both species. Specific studies on behavioral and physiological effects have not been conducted; however, it is likely that the lower levels of human disturbance that would occur under alternative 4 would result in less frequent flight and avoidance responses by wolverines and lynx, reducing energy expenditures and population effects.

Population-level Effects

Population-level impacts on lynx and wolverines under alternative 4 are predicted to be long-term minor adverse because the levels of OSV presence proposed in alternative 4 would likely result in less frequent and lower levels of behavioral responses and displacement effects on lynx and wolverines in the area. Avoidance of areas of OSV use may cause lynx or wolverine to limit their movements, decreasing genetic dispersal. The closure of Sylvan Pass would limits OSV impacts on any females and kits using the denning habitat in that area and on lynx using this area of prime subalpine habitat starting in mid- February, and the lower use levels of motorized vehicles in the rest of the park would limit direct impacts, in turn limiting population-level impacts.

Cumulative Effects

The impacts on lynx and wolverines from past, present, and foreseeable future actions under alternative 4 would be the same as those under alternative 1. These long-term minor to major adverse impacts, when combined with the long-term minor adverse impacts of alternative 4, would result in long-term minor to major adverse cumulative impacts on wolverine and lynx populations in Yellowstone. Alternative 4 would contribute a minimal amount to cumulative impacts, primarily due to continued OSV use in the park.

Conclusion

Under this alternative Sylvan Pass would be closed to OSVs and maintenance activities would cease in the area of the park where human-wolverine interactions are most likely to occur. Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively low levels of use of OSV routes under alternative 4 (up to 110 snowmobiles, 100 wheeled buses, and 30 snowcoaches) would have few impacts on the reproductive success, dispersal, and overall genetic sustainability of the species due to decreased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts under alternative 4 would be short and long-term minor adverse, with long-term beneficial impacts from the removal of human presence at Sylvan Pass. Cumulative impacts under alternative 4 would be long-term minor to major adverse, of which alternative 4 would contribute a minimal amount.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Displacement, Behavioral, and Physiological Effects

Under this alternative road grooming and management of Sylvan Pass would continue, but daily use limits would decrease to roughly a third of current conditions (120 snowcoaches per day) only once the phase out is complete. Prior to the phase out, impacts would be the same as under alternative 2.

After the phase out, under alternative 5, only four to five snowcoaches would be allocated to the east entrance per day, reducing impacts to any wolverine females denning in Sylvan Pass or lynx and wolverines using habitat in the eastern sector of the park, minimizing effects on any reproductive females denning in the area (Pullianian 1968). The continued presence of groomed roads in the park may limit critical dispersal and movements of wolverine between the high-elevation alpine habitats that make up their range. However, the lower OSV limits proposed under alternative 5 would decrease the amount of time that OSV sights and sounds are present in the park. In addition, the reduced frequency at which OSVs traveling the roads maybe encountered would minimize impacts on traveling lynx and wolverines in the central sector of the park. Behavioral and associated physiological effects have never been comprehensively observed, but displacement and movements of wolverine and lynx in relation to habitat and human activity provide an estimate of effects. Observations and GPS data on habitat use and movements indicate that wolverines avoid areas of human activity, including snowmobile routes (Banci 1994). Lynx appear to be able to adapt to moderate levels of human disturbance (Koehler and Brittel 1990; Mowat et al. 1999). Therefore, impacts to these two species under alternative 5 would be localized, short-term negligible to minor adverse. This is because the low-level disturbance from OSVs on the Sylvan Pass road and maintenance activities could adversely impact reproductive success of denning wolverine females, and reduced use levels of groomed OSV roads in the park would minimally limit movements and dispersal of both species. Specific behavioral and physiological effects of human disturbance are unknown. However, it is likely that decreased human disturbance under alternative 5 would result in higher rates of flight or avoidance by wolverines and lynx, because the relatively low OSV limits under alternative

5 would be less likely to cross the unknown ‘low’ disturbance threshold for lynx (Mowat et al. 1999), or for wolverines (Banci 1994). Associated physiological responses would also likely be decreased in these species, with lower levels of exposure to OSVs. This would limit physiological responses.

Population-level Effects

Population-level impacts on lynx and wolverine under alternative 5 would be long-term negligible to minor adverse because the levels of OSV presence would likely result in less frequent and lower levels of behavioral responses and displacement effects on lynx and wolverines in the area. Avoidance of OSV use areas in the central sector of the park may cause lynx or wolverine to limit their movements, decreasing genetic dispersal. But limiting entrance numbers at Sylvan Pass (east entrance) to 4-5 OSVs per day would limit OSV impacts on females and kits in using the denning habitat in the Sylvan Pass area, and on lynx using this area of prime subalpine habitat, and the lower levels of motorized vehicle use in the rest of the park would limit direct impacts, in turn limiting population-level impacts.

Cumulative Effects

The impacts on lynx and wolverines from past, present, and foreseeable future actions under alternative 5 would be the same as those under alternative 1. These long-term minor to major adverse impacts, when combined with the short and long-term negligible to minor adverse impacts of alternative 5, would result in long-term minor to major adverse cumulative impacts on wolverine and lynx populations in Yellowstone. Alternative 5 would contribute a minimal amount to cumulative impacts due to the low levels of OSV use.

Conclusion

Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively low levels of use of OSV routes under alternative 5 (up to 120 snowcoaches) and the low levels of OSV entry limits at the east entrance would have few impacts on reproductive success, dispersal, and overall genetic sustainability of the species due to decreased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under alternative 5 would be short and long-term negligible to minor, adverse. Cumulative impacts to lynx and wolverines under alternative 5 would be long-term minor to major adverse, to which alternative 5 would contribute minimally.

Impacts of Alternative 6: Implement Variable Management

Displacement, Behavioral, and Physiological Effects

Alternative 6 would allow for up to 540 snowmobiles and 78 snowcoaches per day, variable entrance allocations, and 25% of snowmobiles entering the park to be unguided/non-commercially guided. Allowing more OSV use, with a portion of that use unguided/non-commercially guided, could increase the amount of OSV traffic in Sylvan Pass, the prime habitat for lynx and wolverines in the park, increasing the potential for displacement, behavioral, and physiological effects. The end of season closure of Sylvan Pass and the east entrance, after March 1, would reduce impacts on denning wolverines or lynx, during a critical time. Unguided snowmobile users in the park could be more likely to engage in activities that cause increased behavioral responses, displacement, and associated physiological effects, such as traveling at high rates of speed and engaging in improper interactions with wildlife. Such activities have been observed during past winter use seasons (White et al. 2008). Behavioral observations of wildlife also indicate that larger OSV group sizes, such as those allowed under alternative 6, increase behavioral and associated physiological responses by wildlife. Impacts under alternative 6 would be long-term minor adverse due to potential disturbance to wolverine kits and females using the Sylvan Pass area (which may increase displacement of wolverines from the this habitat area), the increased levels of disturbance from more frequent OSV presence on park roads and from larger group sizes, and the higher potential for unguided users to engage in activities that would increase behavioral responses by wolverines and lynx (activities such as off-road travel or high rates of speed).

Population-level Effects

Under alternative 6 road grooming and management of Sylvan Pass would continue, and daily use limits would allow up to 200 more snowmobiles per day than permitted under the 2009 interim rule. Historically, when there were no limits, up to 1,457 and an average of 765 snowmobiles entered the park daily. With the uncertainty regarding avalanche operations and unscheduled closures in Sylvan Pass, use levels Sylvan Pass may increase, but it is not likely to approach historic levels, even on days in which up to 540 snowmobiles are permitted into the park.

Whereas some days may allow for high use, other days would allow for low use, including days with no OSVs entering the park. Variable entrance limits would allow an unspecified number of OSVs to enter the park at the east entrance and travel into the Sylvan Pass area, potentially increasing disturbance of females using the denning habitat found in this part of the park. Observations and GPS data on habitat use and movements indicate that wolverines avoid areas of human activity, including snowmobile routes (Banci 1994), lynx appear to be able to adapt to moderate levels of human disturbance, roads, and snowmobile use (Koehler and Brittel 1990; Mowat et al. 1999). Impacts to lynx and wolverines under this alternative are predicted to be localized, short-term moderate adverse. This is because the possible frequent disturbances from unguided/non-commercially guided and guided OSVs on the Sylvan Pass road (which could increase over current levels due to flexible entrance allocations) and maintenance activities could adversely impact the reproductive success of denning wolverine females. Also, high levels of snowmobile and snowcoach use on groomed OSV roads in the park could limit movements and dispersal of both species. It is likely that the increased human disturbance would result in a more frequent need for flight or avoidance by wolverines and lynx. This is because the high daily OSV limits under alternative 6 may exceed the moderate disturbance threshold for lynx and would likely surpass the low disturbance threshold for wolverines proposed by Banci (1994). There would likely be increased physiological responses in these species with associated higher energy expenditure, because frequency and duration of exposure to OSVs increases, resulting in reduced winter survival rates, and decreased population growth.

Cumulative Effects

The impacts on lynx and wolverine from past, present, and foreseeable future actions under alternative 6 would be the same as those under alternative 1. These long-term minor to major adverse impacts, when combined with the short- and long-term moderate adverse impacts of alternative 6, would result in long-term minor to major adverse cumulative impacts on wolverine and lynx populations in Yellowstone. Alternative 6 would contribute a noticeable amount to cumulative impacts on lynx and wolverines.

Conclusion

Restrictions to movements of lynx or wolverines during the winter months due to the presence and relatively high levels of use of OSV routes under alternative 6 (up to 540 snowmobiles and 78 snowcoaches), and the potential for higher OSV entry limits at the east entrance would have increased impacts on reproductive success, dispersal, and overall genetic sustainability of the species due to the increased frequency and duration of exposure to the sights and sounds of human activity. Therefore, impacts predicted under alternative 6 would be short and long-term moderate adverse. Cumulative impacts to lynx and wolverines under alternative 6 would be long-term minor to major adverse, of which alternative 6 would contribute a noticeable amount.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Displacement, Behavioral, and Physiological Effects

Alternative 7 would continue road grooming and management of Sylvan Pass, the closest OSV route to prime lynx and wolverine habitat in the eastern sector of the park. Wolverine females give birth to young in mid-February, during peak OSV season, and one natal den was found in Sylvan Pass. Because denning females are likely sensitive to human disturbance (Myrberget 1968; Pullianian 1968), OSV use and maintenance (particularly avalanche control methods) may cause wolverines using the area to leave, and/or cause females to abandon their dens for poorer den sites, increasing kit mortality and decreasing the reproductive success of wolverines. The end of season closure of the east entrance and east side road would reduce the impacts of OSVs on wolverines in the area, but OSV use would still overlap for about two weeks. Male wolverines travel extensively during the winter, periodically checking in with females they have mated with, and with females and kits after the birth of young. Wolverines and lynx in Yellowstone are on the southern tip of their range in North America, and suitable habitat for both species in the greater Yellowstone area occurs in patches, separated by poor habitat (Brock et al. 2007). Documented movements of a dispersing, GPS collared wolverine during the winter months traveling across the central range of Yellowstone, indicates that disturbance in any area of the park could impact dispersal and movements of wolverines, even if disturbances occur outside of areas of ideal habitat for either species (Wildlife Conservation Society 2007).

Behavioral and associated physiological effects associated with OSV use have never been specifically investigated for these species. However, observations of habitat use indicate that wolverines avoid areas of human activity, including snowmobile routes (Banci 1994). Lynx appear to be able to adapt to moderate levels of human disturbance and snowmobile use (Koehler and Brittel 1990; Mowat et al. 1999). Therefore, impacts to these two species under alternative 7 are predicted to be localized, short-term minor adverse because disturbance from OSVs on the Sylvan Pass road and maintenance activities could adversely impact the reproductive success of denning wolverine females. Although early closure of Sylvan Pass and the east side to OSV travel (March 2 to 15), would reduce disturbance of female wolverines by OSVs, female wolverines may begin denning in mid-February, and thus OSV use may overlap with wolverine denning time. Depending on how far these species travel outside the minimally travelled, eastern section of the park, impacts have the potential to be moderate adverse, because groomed OSV roads in other areas of the park could limit movements of both species. For lynx and wolverines traveling outside the park, early closure of the east entrance would have little effect.

Specific behavioral and physiological effects are unknown, because habituation to the levels of OSV use that would occur in Yellowstone under alternative 7 has never been observed. However, it is likely that increased human disturbance would result in higher rates of flight or avoidance by wolverines and lynx. Additionally, associated physiological responses would also likely be increased in these species with exposure to OSVs. Physiological responses generally result in increased energy expenditures.

Population-level Effects

Under this alternative Sylvan Pass would remain open. Because wolverine females give birth in mid-February and there is at least one known den in Sylvan Pass, there is a risk of disturbance of denning females and kits. Disturbance by OSVs and Sylvan Pass maintenance activities may result in lower quality parental care by female wolverines both prior to weaning at 10 weeks, and before young wolverines set off on their own, generally at around one year old (Pullianian 1968). Wolverines reproduce at very slow rates, with females reaching reproductive age at about 3 years of age. Wolverines birth only one kit an average of every 2.3 years (Inman et al. 2007b) and female reproductive success is critical to ensure the long-term viability of the species in the area.

Impacts to lynx may be long-term minor adverse effects because the mating season of the lynx overlaps OSV use in the park by about 2 weeks, and roaming lynx or wolverine’s travels may be limited by groomed OSV use and disturbance (Copeland 1996; Mowat and Slough 1998). The early closure of the east entrance to OSV use (March 2 to 15), would minimize OSV disturbance to lynx in this area, but lynx traveling between territories may still be affected by OSV use in the park. Lynx appear somewhat able to adapt to moderate levels of human disturbance, thus the highest east entrance levels of 22 snowmobiles and 2 snowcoaches per day, resulting in up to 5 OSV groups/day proposed under alternative 7 would keep snowmobile traffic in the area at low levels. Radio/GPS collar tracking indicates that wolverines may travel up to 50 miles in a 17-hour period, and travel through non-preferred habitat, including the central portion of Yellowstone (Inman et al. 2007a). These travels may result in interactions between these animals and OSVs or groomed roads, even if lynx and wolverines are rarely seen by winter users due to the animals’ keen senses and general avoidance of human activity.

Population-level impacts on lynx and wolverines under alternative 7 are predicted to be long-term minor adverse. Lynx and wolverines have large home range sizes and the travel between patchy habitat is important to population viability. Groomed roads and OSV presence may disrupt travel patterns of lynx or wolverines.

Cumulative Effects

Impacts on lynx and wolverines from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor to major adverse effects of these actions, when combined with the short- and long-term minor adverse impacts to potentially long-term moderate adverse impacts of alternative 7, would result in short- and long-term minor to major adverse cumulative impacts on these species. Alternative 7 would contribute a small amount to cumulative impacts, primarily due to continued OSV use in the park, and Sylvan Pass.

Conclusion

This alternative would maintain and allow OSV use in Sylvan Pass, the area of the park where human-wolverine interactions would be most likely to occur. However, daily entrance limits restrict the east entrance to just 22 snowmobiles and 2 snowcoaches per day, (five groups of OSVs), resulting in little use in this area, and minimal disturbance to wolverines. Restrictions on movements of lynx or wolverines during the winter months due to the presence and use of OSV routes in other areas of the park may limit the reproductive success, dispersal, and overall genetic sustainability of the species, but such impacts are difficult to predict. Therefore, impacts predicted under this alternative would be long-term minor adverse, with the potential for moderate adverse impacts if lynx and wolverines travel outside the eastern area of the park. Cumulative impacts to lynx and wolverines under alternative 7 would be long-term minor to major adverse, to which alternative 7 would contribute a small amount.

TRUMPETER SWANS AND EAGLES

Both swans and eagles primarily use riparian or lakeside habitat in the park, and were regularly observed during NPS annual behavioral monitoring. Both are able travel via flight, limiting barrier impacts of roads in or outside the park, and of ground disturbance to these species outside nesting, hunting or feeding areas. These areas used by swans and eagles occur along lakes or in riparian areas, which are also popular OSV corridors. Therefore impacts by OSVs on these species are similar and they are combined for analysis.

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Displacement, Behavioral, and Physiological Effects

OSV use in the park would be minimal and limited to administrative use only. Displacement of bald eagles and swans is possible due to this occasional administrative use or to skiers or snowshoers in the park, but such displacement would be infrequent and short term, and a 400-meter no-stopping buffer around roosting or nesting eagles would remain in place for bald eagles in the park, which would reduce the risk of disturbance to eagles. The potential for other behavioral and physiological effects that could occur due to disturbance by foot traffic and low-level administrative traffic would be low, because this traffic would be so minimal under alternative 1. For these reasons, impacts from alternative 1 would be localized, short-term negligible adverse. Long-term impacts would be beneficial because during the majority of the winter season human disturbance would be removed.

Population-level Effects

The vast majority of effects would result from a small number of skiers or snowshoers, who are only rarely expected to encounter trumpeter swans or eagles. Winter users would not be present during the active nesting season for trumpeter swans, and skiers or snowshoers rarely elicit any response from wildlife (McClure et al. 2009; McClure et al. 2008), resulting in no impacts to the critical reproductive periods, mortality, or nesting that could lead to population-level effects. Impacts from population-level effects on swans and eagles under alternative 1 would therefore be long-term negligible adverse.

Mitigation

The park would be managed as a backcountry area for skiers or snowshoers. A 400-meter no stopping buffer would remain in place for bald eagles in the park, limiting the effects of skiers or snowshoers on eagles.

Cumulative Effects

Other past, present, and foreseeable future actions in and around Yellowstone have the potential to impact swans and eagles, particularly because these species are highly mobile during the winter and year-round, and are able to fly outside Yellowstone. Any actions that reduce the ability of swans to produce viable offspring could further contribute to observed regional declines in the species population.

The Gallatin National Forest has consolidated much of its checkerboard holdings in recent years, which has been accompanied by consolidation of private lands, especially in the Big Sky area. The net effect of these consolidations on eagles and swans is difficult to predict, because consolidated USFS lands are less likely to be developed, whereas private lands are more likely to be developed.

Road construction projects in the park, such as the recent projects at the east entrance and Madison to Norris roads, have been or are being constructed in accordance with appropriate environmental reviews and mitigation measures so as to reduce impacts on wildlife in the region. Within the park, construction is also generally designed to minimize effects on wildlife. Overall, all construction projects in the region must minimize the effects of any projects on bald eagles. Swans are similarly protected under the Migratory Bird Treaty Act. Additionally, swans and eagles are rarely killed on roads. Impacts due to road development and construction in the greater Yellowstone area would be localized, long-term negligible to moderate adverse.

The negligible to moderate impacts of these past, present, and reasonably foreseeable future actions, combined with the short- and long-term negligible adverse impacts of alternative 1, would result in long-term minor adverse cumulative impacts on trumpeter swans and bald eagles. Alternative 1 would not include visitor OSV use in the park and would contribute only a small amount to the overall cumulative impacts.

Conclusion

Alternative 1 would result in short- and long-term negligible adverse impacts on swans and eagles in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts. Cumulative impacts would be long-term minor adverse, and alternative 1 would contribute a minimally to the overall cumulative impacts to eagles and swans.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Displacement, Behavioral, and Physiological Effects

Alternative 2 would allow for OSV use up to current permitted use levels under the 2009 interim rule at 318 guided snowmobiles and 78 snowcoaches per day. Recent observations of behavior demonstrate few active responses by eagles or swans when exposed to OSVs, with 80% of swans and 62% of eagles showing no reaction to OSVs, 8% of swans and 9% of eagles traveling away from disturbance, and no swans and 3% of eagles exhibiting a flight response (McClure et al. 2009). The likelihood of an active response by bald eagles and swans increase with decreased distance to the road, longer interaction time, direct approach or harassment by humans, approach by humans on foot, and, for eagles, burned forest habitat compared to open meadow (Grubb et al. 2002; Gonzalez et al. 2006; Borkowski et al. 2006; White et al. 2006). Therefore, behavioral observations under use levels during the 2009 interim rule show limited displacement and few energetically costly behavioral responses, which would also likely limit physiological responses in swans and eagles. This indicates that a majority of both swans and eagles are expected to demonstrate limited responses to OSVs under the use limits proposed for alternative 2, which includes the same limits on OSVs as the 2009 interim rule. Also, swans demonstrate some level of habituation to OSV users (Hardy 2001; White et al. 2008), and guiding requirements in alternative 2 would limit actions by humans (e.g., interaction time) that precipitate stronger responses by swans and eagles. For these reasons, impacts on swans and eagles under alternative 2 would be localized, short-term negligible to minor adverse.

Population-level Effects

For bald eagles, increased behavioral responses to OSVs may result in reproductive failure or mortality if eagles avoid accessing prime foraging areas, or are subject to such frequent flight responses that their eggs or young fail to survive. These responses may also require increased energy due to stress and increased activity (Stalmaster and Kaiser 1998; Steidl and Anthony 2000), because their critical breeding and nesting season overlaps with OSV use in the park. Researchers have linked human disturbance to temporary and permanent nest abandonment by swans, along with movement from preferred breeding areas (Bangs et al. 1982). Although swans incubate eggs in May and hatch in June, well outside the time period of OSV use in the park, breeding pairs of swans begin choosing territories as early as February. Therefore, any increases in the frequency and duration of encounters between OSVs and swans or eagles and increases in duration of encounters heighten the probability of adverse impacts on the reproductive success of both species. However, there are successful swan breeding territories near motorized routes in the greater Yellowstone area outside the park (McEneaney 2006), and OSV have not been shown to be the primary factor in the decline of the resident swan population (Proffitt 2008). Eagle nests may fall within the 250 meter buffer distance specified for protection by the USFWS (USFWS 2008a). For example, foraging or roosting eagles near the Firehole and Madison drainages are often less than 250 meters from the road. Eagles exhibit increased behavioral response frequency and intensity with shorter distance to disturbance, number of vehicles per event, and interaction duration and rates (Gonzalez et al. 2006; White et al. 2008). However, current management protocols include a 400-meter no-stopping buffer, so OSV traffic would not be permitted to stop near any such nest when it is occupied. Thus, population-level impacts under alternative 2 to both swans and eagles would be localized, long-term negligible to minor adverse.

The impacts described above would be mitigated under this alternative in several ways. Monitoring of human-wildlife interactions would continue under all alternatives. If NPS monitoring indicates that human presence or activities have unacceptable effects on swans or eagles that cannot be otherwise mitigated, selected areas of the park (including sections of roads) may be closed to visitor use. Additionally, any area containing a nesting pair of swans would be closed by park management, and there is a mandatory no-stopping requirement in a 400-meter buffer zone from bald eagle nests. The park has the authority to close areas of the park for wildlife protection, such as to prevent disturbance of nesting eagles, or to enforce a buffer zone. Such closures would effectively limit adverse impacts of OSV use.

Cumulative Effects

Impacts on trumpeter swans and bald eagles from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The negligible to moderate adverse effects of these actions, when combined with the short- to long-term negligible to minor adverse impacts of alternative 2, would result in short- and long-term minor adverse cumulative impacts on these species. Alternative 2 would contribute a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 2 would limit impacts to swans and eagles through use-limits, guiding requirements, and little overlap of OSV use with the active swan nesting season. Given these conditions and the mitigation measures discussed above, impacts to eagles and swans under alternative 2 would be localized short- to long-term negligible to minor adverse. Cumulative impacts would be long-term minor adverse, and alternative 2 would contribute a small amount to the overall adverse cumulative impacts.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Displacement, Behavioral, and Physiological Effects

Alternative 3 would allow up to 720 guided snowmobiles and 78 snowcoaches per day, nearly double the level currently permitted. Recent wildlife behavioral observations found few active responses by eagles or swans when exposed to OSVs, as described under alternative 2. From 2004 to 2009, daily limits were up to 720 snowmobiles and 78 snowcoaches, but actual use was lower, similar to the limits proposed under alternative 3. During this time, 60% of swans and 17% of eagles showed no response to OSVs, and 10% of eagles and 10% of swans responded with travel or flight (White et al. 2006, White et al. 2008). Thus, vigilance responses appeared to increase with higher OSV use levels. There would likely be more vigilance responses by both swans and eagles with higher use levels, which may increase non-visible physiological responses and associated nesting success. However, swans demonstrate some level of habituation to OSV users, and guiding requirements would limit actions by humans (e.g., increased interaction time) that precipitate stronger responses by swans and eagles. Therefore, impacts on swans and eagles under alternative 3 would be localized short-term minor adverse.

Population-level Effects

For bald eagles and swans, increased behavioral responses to OSVs may result in reproductive failure, mortality, or nest abandonment, as described under alternative 2. However, guiding requirements would limit human activities that precipitate stronger responses by swans and eagles Thus, due to increased frequency of OSV encounters with higher daily entrance limits and increased vigilance responses of bald eagles and swans when exposed to the OSV numbers proposed under alternative 3, population-level impacts under alternative 3 would be long-term minor adverse.

Cumulative Effects

Impacts on trumpeter swans and bald eagles from other past, present, and reasonably foreseeable future action would be the same as described for alternative 1. The negligible to moderate adverse effects of these actions, when combined with the short- to long-term minor adverse impacts of alternative 3, would result in short- and long-term minor adverse cumulative impacts on these species. Alternative 3 would contribute a noticeable amount to the overall adverse cumulative impacts.

Conclusion

Alternative 3 would limit impacts to swans and eagles as described in alternative 2, but would allow for a greater number of OSVs in the park on a daily basis and would result in short and long-term minor adverse impacts. Cumulative impacts would be long-term minor adverse, and alternative 3 would contribute a noticeable amount to the overall adverse cumulative impact.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Displacement, Behavioral, and Physiological Effects

Alternative 4 would reduce daily OSV levels to up to 110 guided snowmobiles and 30 snowcoaches per day, and would plow the park road from the west and north entrances to Old Faithful, with a limit of up to 100 guided, wheeled vehicles on these roads. Recent wildlife behavioral observations found few active responses by eagles or swans when exposed to OSVs, as described under alternative 2.

Road plowing itself would have little effect on bald eagles or swans, because they are mainly found along river drainages and lakes, and fly from one location to another. Wheeled vehicle use and plowing would take place on roads where the majority of encounters between OSVs and eagles or swans currently occur (McClure et al. 2009). Guided wheeled vehicles would have effects on swans and eagles similar to those from snowcoaches because they are of similar size. The potential for human behavior that precipitates more frequent and higher level responses, such as direct approach, stopping, or increased duration of interaction would be reduced due to the relatively low (100) wheeled vehicle limit and guiding requirements. Although buses could continue to pass within 250 meters of nests due to road location, fewer buses would pass by on a daily basis. A majority of both swans and eagles would be exposed to fewer motorized vehicles per day, and guiding requirements would limit actions by humans (e.g., interaction time) that precipitate stronger responses by swans and eagles. Also, swans demonstrate some level of habituation to OSV users. Therefore impacts on swans and eagles under alternative 4 would be localized short-term negligible adverse.

Population-level Effects

For bald eagles and swans, increased behavioral responses to OSVs may result in reproductive failure, mortality, or nest/nest site abandonment, as described under alternative 2. Therefore, the decrease in the frequency of interaction and reduction in duration of contact between OSVs and swans or eagles under alternative 4 would reduce the risk of adverse impacts on the reproductive success of both species. The 400-meter no-stopping buffer near eagle nests and regulations on group size and entrance limits would decrease the duration and frequency of encounters with OSVs, The lower daily entrance limits of wheeled buses in the area of the park where the majority of encounters between eagles or swans and OSVs currently occur would decrease the frequency of these encounters. Also, guiding requirements would limit human activities that precipitate stronger responses by swans and eagles. Thus, population-level impacts under alternative 4 would be long-term negligible adverse.

Cumulative Effects

Impacts on trumpeter swans and bald eagles from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The negligible to moderate adverse effects of these actions, when combined with the short- to long-term negligible adverse impacts of alternative 4, would result in short- and long-term minor adverse cumulative impacts on these species. Alternative 4 would contribute a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 4 would limit impacts to swans and eagles due to low use limits, reduction in overall motorized vehicle use in the winter within the park, guiding requirements, and little overlap with active swan nesting season. The low use levels and guiding requirements would result in localized short and long-term negligible adverse impacts to eagles and swans under alternative 4. Cumulative impacts would be long-term minor adverse, and alternative 4 would contribute a small amount to the overall adverse cumulative impacts.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Displacement, Behavioral, and Physiological Effects

Initially impacts under alternative 5 would be the same as alternative 2. Alternative 5 could reduce use levels to 120 guided snowcoaches per day and zero snowmobiles. Recent wildlife behavioral observations found few active responses by eagles or swans when exposed to OSVs, as described in alternative 2. Decreasing current use levels to roughly one-third would result in reduced frequency of interactions between OSVs and eagles or swans, overall decreasing interaction duration, and resulting in fewer adverse behavioral, physiological, and displacement effects. The potential for human behavior that precipitates more frequent and higher level responses, such as direct approach, stopping, or increased duration of interaction would be reduced due to the relatively low (120) snowcoach limit, and guiding requirements. Although snowcoaches would continue to pass within 250 meters of nests due to road location, fewer overall OSVs would pass by on a daily basis. A majority of both swans and eagles would be exposed to fewer OSVs per day, and guiding requirements would limit actions by humans (e.g., increased interaction time) that precipitate stronger responses by swans and eagles. Also, swans demonstrate some level of habituation to OSVs. Therefore impacts on swans and eagles under alternative 5 would be localized short-term negligible adverse.

Population-level Effects

For bald eagles and swans, increased behavioral responses to OSVs may result in reproductive failure, mortality, or nest abandonment, as described under alternative 2. The 400-meter no-stopping buffer near eagle nests and regulations on group size and low entrance limits would decrease the duration and frequency of encounters with OSVs. Lower daily entrance limits of snowcoaches would decrease the frequency of vehicle encounters. Also, guiding requirements would limit human activities that precipitate stronger responses by swans and eagles. Thus, population-level impacts under alternative 5 would be long-term negligible adverse,

Cumulative Effects

Impacts on trumpeter swans and bald eagles from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The negligible to moderate adverse effects of these actions, when combined with the short- to long-term negligible adverse impacts of alternative 5, would result in short- and long-term minor adverse cumulative impacts on these species. Alternative 5 would contribute a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 5 would limit the impacts to swans and eagles through low use limits, guiding requirements, and little overlap between OSV use and the active swan nesting season. The low use levels and guiding requirements would limit impacts to eagles and swans under alternative 5 and result in localized short and long-term, negligible, adverse impacts. Cumulative impacts would be long-term minor adverse, and alternative 5 would contribute a small amount to the overall adverse cumulative impacts.

Impacts of Alternative 6: Implement Variable Management

Displacement, Behavioral, and Physiological Effects

Alternative 6 would increase use levels to up to 540 snowmobiles, and up to 78 snowcoaches per day, with a wide range of variability in the numbers of OSVs that could enter the park daily, with days of zero use also possible. Up to 25% of snowmobiles would be unguided or non-commercially guided, and daily entrance allocations and entrance limits would vary throughout the winter use season. From 2004 to 2009, when actual use levels (average daily use of 258 snowmobiles and 30 snowcoaches, peak daily use of 488 snowmobiles and 55 snowcoaches a year) were similar to those proposed under alternative 6, 60% of swans and 17% of eagles showed no response to OSVs, and 10% of eagles and 10% of swans responded with travel or flight. It is likely that actions by unguided snowmobile users, including stopping near nesting or roosting eagles and direct approach, would increase the potential for higher level and more frequent behavioral responses by swans and eagles (Grubb et al. 2002). Additionally, increases in snowmobile group size to 22 under alternative 6 would increases the likelihood of stronger behavioral responses by swans and, to a lesser extent eagles (White et al. 2006). Therefore, there would likely be more vigilance responses by both swans and eagles under alternative 6 with higher use levels and the unguided user provision, which may increase non-visible physiological responses and decrease associated nesting success. Increasing current use levels would result in increased frequency and duration of interactions between OSVs and eagles or swans and more adverse behavioral, physiological, and displacement effects. The guiding requirements for the majority of snowmobiles and for all snowcoaches under this alternative would limit actions by humans that precipitate stronger responses by swans and eagles, and the larger group size could reduce the numbers of groups, but the potential for human activity that would elicit more frequent and/or higher level responses would be increased due to the inclusion of unguided tours. Both swans and eagles would be exposed to more OSVs per day, but swans demonstrate some level of habituation to OSVs. Therefore impacts on swans and eagles under alternative 6 would be localized, short-term minor to potentially moderate adverse

Population-level Effects

For bald eagles and swans, increased behavioral responses to OSVs may result in reproductive failure, mortality, or nest abandonment, as described under alternative 2. The 400-meter no-stopping buffer near eagle nests and regulations on group size and entrance limits decreases the duration and frequency of encounters with OSVs. However, the unguided user provision and relatively high use limits under alternative 6 may result in increased adverse responses by eagles and swans to OSVs, increasing energy expenditure, and possibly decreasing survival and reproductive rates of eagles and swans. Also, there would be increased frequency of vehicle encounters with higher daily entrance limits of OSVs. The OSV use season overlaps with the establishment of nesting territory by breeding pairs of swans. Increased behavioral responses by swans to OSV use under alternative 6 may result in minor to moderate impacts. There is little overlap of OSV use with the active swan nesting season, which would limit impacts to that species. Population-level impacts under alternative 6 would be long-term minor to moderate adverse.

Cumulative Effects

Impacts on trumpeter swans and bald eagles from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The negligible to moderate adverse effects of these actions, when combined with the short- to long-term minor to moderate adverse impacts of alternative 6, would result in short- and long-term minor to moderate adverse cumulative impacts on these species. Alternative 6 would contribute a noticeable amount to the overall adverse cumulative impacts.

Conclusion

Alternative 6 would limit impacts to swans and eagles due to use-limits, guiding requirements, and little overlap between OSV use and the active swan nesting season, but would increase OSV use levels on some days beyond current use levels. Impacts to eagles or swans under alternative 6 would be short- and long-term minor to moderate adverse because use levels would increase and up to 25% unguided/non-commercially guided snowmobile use would be permitted. Cumulative impacts would be long-term minor to moderate adverse, and alternative 6 would contribute a noticeable amount to the overall adverse cumulative impacts.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Displacement, Behavioral, and Physiological Effects

Alternative 7 would allow for OSV use just above the current permitted use levels under the 2009 interim rule for half the winter season, at 330 guided snowmobiles and 80 snowcoaches per day. Recent observations of behavior demonstrated few active responses by eagles or swans when exposed to OSVs, with 80% of swans and 62% of eagles showing no reaction to OSVs, 8% of swans and 9% of eagles traveling away from the disturbance, and no swans and 3% of eagles exhibiting a flight response (McClure et al. 2009). Flexible daily limits, that may result in blocks of time (weeks or days) with maximum entrance numbers, when combined with the 10:30 a.m. entrance cut-off, may result in concentrating OSV use into a shorter time period along routes, such as Madison to Old Faithful, where OSV and eagle or swan encounters occur. The likelihood of an active response by bald eagles and swans increases with decreased distance to the road, longer interaction time, direct approach or harassment by humans, approach by humans on foot, and, for eagles, burned forest habitat compared to open meadow (Grubb et al. 2002; Gonzalez et al. 2006; Borkowski et al. 2006; White et al. 2006). Even with OSV group size limits, frequent encounters with OSVs may increase the likelihood of a heightened behavioral response, because closely spaced OSV groups may have similar effects to that of larger OSV group size and longer interaction time between OSVs and wildlife.

Behavioral observations under use levels under the 2009 interim rule, show limited displacement, and few energetically costly behavioral responses which would also likely limit physiological responses in swans and eagles. Therefore a majority of both swans and eagles are expected to demonstrate limited responses to OSVs under the use limits proposed for alternative 7, which includes maximum OSV use limits similar to the 2009 interim rule, during half the winter use season. Swans demonstrate some level of habituation to OSV users (Hardy 2001; White et al. 2008), and guiding requirements in alternative 7 would limit actions by humans (e.g., increased interaction time) that precipitate stronger responses by swans and eagles. For these reasons, impacts on swans and eagles under alternative 7 would be localized, short-term negligible to minor adverse.

Population-level Effects

Because bald eagle critical breeding and nesting season overlaps with OSV use in the park, increased behavioral responses to OSVs may result in reproductive failure or mortality if eagles avoid accessing prime foraging areas or if eagles are subject to such frequent flight responses that they abandon the nest, or eggs fail to survive, or require increased energy due to stress and increased activity (Stalmaster and Kaiser 1998; Steidl and Anthony 2000). Researchers have linked human disturbance to temporary and permanent nest abandonment by swans, along with movement from preferred breeding areas (Bangs et al. 1982). Although swans incubate eggs in May and hatch in June, which is well outside the time period of OSV use in the park, breeding pairs of swans begin choosing territories as early as February. Therefore, any increases in the frequency or duration of encounters between OSVs and swans or eagles heighten the probability of adverse impacts on the reproductive success of both species. However, there are successful swan breeding territories near motorized routes in the greater Yellowstone area outside Yellowstone (McEneaney 2006), and OSV have not been shown to be the primary factor in the decline of the resident swan population (Proffitt 2008). OSVs may travel within the 250-meter buffer distance specified for protection by the USFWS (USFWS 2008a). For example, foraging or roosting eagles near the Firehole and Madison drainages are often less than 250 meters from the road. Eagles exhibit increased behavioral response frequency and intensity with shorter distance to disturbance, number of vehicles per event, and interaction duration and rates (Gonzalez et al. 2006; White et al. 2008). Current management protocols include a 400-meter no-stopping buffer, so OSV traffic would not be permitted to stop near any such nest when it is occupied. Thus, population-level impacts under alternative 7 to both swans and eagles would be localized, long-term negligible to minor adverse.

Mitigation measures under this alternative would be the same as those described under alternative 2, with the addition of the 10:30 a.m. entrance limit for OSVs, which would concentrate OSV use. Alternative 7 also would close the east entrance to OSVs from December 15 to 21 and in the spring, from March 2 to 15, during the last two weeks of the winter use season. Early closure of the east entrance would have little impact on eagles and swans, because they are not generally found in the east sector of the park. Variable daily entrance limits would result in reduced OSV traffic during half of the winter season, but park planning would allow for annual variation that would increase limits during periods of greater visitor demand. This may mean that entrance numbers would be similar to those under alternative 2, because visitor demand fluctuates during the winter use season and periods of high demand would be filled to the maximum limit, whereas periods of low demand would remain at levels below the allowed maximum.

Cumulative Effects

Impacts on trumpeter swans and bald eagles from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The negligible to moderate adverse effects of these actions, when combined with the short- to long-term negligible to minor adverse impacts of alternative 7, would result in short- and long-term minor to moderate adverse cumulative impacts on these species. Alternative 7 would contribute minimally to the overall adverse cumulative impacts.

Conclusion

Alternative 7 would limit impacts to swans and eagles through use-limits, guiding requirements, and little overlap of OSV use with the active swan nesting season. Given these conditions and the mitigation measures discussed above, impacts to eagles and swans under alternative 7 would be localized short- to long-term negligible to minor adverse. Cumulative impacts would be long-term minor to moderate adverse, and alternative 7 would contribute minimally to the overall adverse cumulative impacts.

GRAY WOLVES

Since their reintroduction from 1995 to 1997, wolf numbers increased until 2003, when density-dependent factors unrelated to OSV use (including disease) caused declines. Wolves within the Yellowstone area are classified as a non-essential, experimental population by the USFWS, and per the ESA (10(j)), are managed within Yellowstone as a threatened population. Gray wolves rarely encounter OSV users in the park, and it would appear that wolves avoid areas of frequent OSV use (McClure et al. 2009). During winter foraging travels, gray wolves frequent ungulate winter ranges including the Yellowstone northern range and areas of geothermic influence in the park (Green et al. 1997); there are fewer wolves in the interior of the park than on the northern range because there are fewer elk in the interior (Smith et al. 2010, Sacklin pers. comm. 2010). Elk make up 83% of their diet, and other ungulates compose most of the remainder. Ungulate carcasses from winter-kill are also consumed during the spring denning season (Creel et al. 2007). During winter, wolves appear to travel primarily at night when in developed areas, with several nocturnal kills documented in these areas. Wolves den in April, after the winter use season has ended (Smith et al. 2010).

Disturbance to wolves from OSV use has been occasionally observed during wildlife monitoring surveys, and the majority of wolf responses to OSV use consisted of “look-resume” or no visible response (McClure et al. 2009). Although higher glucocorticoid levels have been documented in wolves at locations and times with increased snowmobile use, there is no evidence that this has caused population-level effects (Creel et al. 2002). Compacted OSV routes may provide low energy winter travel routes for wolves to access areas of ungulate use, or may direct the movements of wolves along roads, due to the ease of travel.

Wolves in and around Yellowstone rarely pose a threat to humans or demonstrate begging behaviors or approach humans, due in to an abundance or native prey animals, general avoidance of humans, and, in part to hazing of any wolves frequenting areas of human use or development, or observed approaching people. In 2009, the four member Canyon wolf pack were successfully hazed away from a denning site near Mammoth Hot Springs. Although the pack did not approach humans and were not food conditioned, the amount of human use in the area frequented by the wolves was an issue. After hazing, the pack moved on to its summer range in Hayden Valley. During the previous summer, prior to the hazing events of spring 2009, the wolves had approached vehicles, and frequently traveled on the Hayden Valley road. In summer 2009, following hazing, the Canyon wolves did not demonstrate these behaviors. The success of hazing with this pack and other wolf hazing in the park, indicates that hazing is a successful strategy for habituated wolves, and effectively stops unwanted behaviors (Smith et al. 2010). Due to its level of habituation, hazing was not attempted on a yearling wolf from the Gibbons pack; this wolf was lethally removed on May 19, 2009 because of apparent food conditioning and habituation to humans demonstrated by the wolf approaching humans and chasing several park visitors. This wolf had likely been fed by people (Smith et al. 2010). Guiding requirements, education on proper storage of food and behavior around wildlife, and limits to the total number of visitors a day limit the development of habituation in park wolves due to winter use. It appears that wolves generally avoid encounters with OSV users, and may preferentially choose to travel on OSV roads during times of low human activity (Smith et al. 2008, 2009, 2010).

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Displacement, Behavioral, and Physiological Effects

Though a few visitors might travel into the park on foot (skiers and snowshoers), it is unlikely that they would venture far into the park or into the winter ranges of wolves or that visitors would encounter any roaming wolves anywhere else in the park due to the scarcity and elusiveness of wolves and their propensity for night or dusk travel, when humans are generally not active in the park (Smith et al. 2009). Because no OSV use would be permitted under this alternative, OSVs would not operate in the wolves’ winter range. Encounters are possible, but wolves are likely to generally avoid interaction and effects would be short-term and rare. Therefore minimal displacement is expected to occur under this alternative and behavioral and physiological effects would be extremely rare. Displacement, behavioral, and physiological impacts on wolves under alternative 1 would be localized, short-term negligible adverse.

Population-level Effects

Under this alternative there would be minimal population-level effects such as disturbance during denning season, or disruption of hunting success. This is because there would be a nearly complete lack of interaction or encounters between winter users and wolves. Impacts would be long-term negligible adverse.

Cumulative Effects

Wolves are listed as endangered in the Northern Rockies, and are therefore covered under the ESA. This requires that the states must maintain long-term viability of wolves. Wolves are classified as experimental populations in southern Montana, Idaho south of I-90, and all of Wyoming, which allows for greater management flexibility; however, regulations are meant to limit adverse impacts. Experimental classification could lead to culling and result in both long- and short-term minor to moderate adverse impacts on wolf populations in the greater Yellowstone area.

The Gallatin National Forest Travel Plan Revision, and the Beartooth Custer National Forest Travel Management Plan are now being implemented. Actions associated with these plans could affect wolves, but negative effects would be minimized because federal and state wildlife management agencies are required to ensure the long-term viability of wolves in their planning efforts and projects. Impacts would be long-term negligible to minor adverse.

The Gallatin National Forest has recently consolidated much of its checkerboard public and private land holdings, accompanied by the consolidation of private lands, particularly in the Big Sky area. This means there are larger tracts of public land that are less likely to be developed, but also large areas of private lands that are more likely to be developed. The net effects of these actions on wolves are difficult to predict.

The Gardiner Basin and Cutler Meadows restoration (currently in progress) would likely benefit wolf prey species, because the prey species preferred browse of native plants would be favored by these restorations, with overall long-term beneficial impacts to wolves.

Any of the above actions that increase or decrease the population of prey/carcass availability for wolves would also affect their range and population in the study area.

Impacts of past, present, and foreseeable future actions would be long-term minor adverse. The impacts of these past, present, and reasonably foreseeable future actions, combined with the short and long-term negligible adverse impacts of alternative 1, would result in long-term minor adverse cumulative impacts on wolves. Alternative 1 would contribute a small amount to the overall cumulative impacts.

Conclusion

Alternative 1 would result in short- and long-term negligible adverse impacts on wolves in the park because OSV use would be limited to minimal administrative use and there would be no observable impacts. The limited human presence would have long-term beneficial impacts. Cumulative impacts would be long-term, minor, adverse, and alternative 1 would contribute a small amount to the overall cumulative impacts.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Displacement, Behavioral, and Physiological Effects

Alternative 2 would continue use levels under the 2009 interim rule of up to 318 guided snowmobiles and 78 guided snowcoaches per day. Winter road monitoring crews rarely observed behavioral responses by wolves to OSVs in Yellowstone, due to infrequent encounters, with a total of only 14 sightings of wolf-OSV interaction over the last seven winter monitoring seasons. Generally, responses by wolves are either look-resume or no visible response (McClure et al. 2009). Glucocorticoid measurements from wolves in Yellowstone and other areas where wolves are exposed to snowmobiles were correlated between and within years during periods of higher OSV activity (Creel et al. 2002). Chronic elevated glucocorticoid levels may result in long-term adverse effects on immune function and body condition, decreasing survival and reproductive rates (Sapolsky 1992). No evidence exists for population-level effects (Creel et al. 2002). Also, frequent exposure to humans may result in habituation by wolves, resulting in possible lethal removal if wolves lose fear of humans and begin to engage in problematic behaviors such as approaching humans or chasing visitors (Smith et al. 2010).

Wolves appear to avoid interaction with OSV users, but there is no evidence from wolf territories in the park of large-scale displacement or habitat avoidance (Smith et al. 2005). Observations of habitat use by radio-collared wolves indicate that wolves frequently travel in the Madison-Firehole-Gibson basin during Winter OSV use, but avoid areas of human activity during the day. Wolf tracks were frequently observed on roads at night, suggesting that wolves travel on roads at night to conserve energy but avoid OSV activity during the day (Smith et al. 2005; Smith et al. 2006). It appears that wolves avoid encounters with OSVs and maintain normal travel activities in the park. Wolves may travel on roads to conserve energy, but they do not appear to follow roads for long distances, or to areas they would not frequent otherwise. Physiological responses would likely be increased with increased numbers of OSVs in the park, but guiding requirements and use-limits under alternative 2 would limit these responses. Therefore, impacts under alternative 2 would be localized, short-term negligible to minor adverse.

Population-level Effects

Wolf populations in the park have grown during periods of much higher OSV use than those occurring under recent conditions (with daily averages of 795 snowmobiles/day), and data suggest that inter-species aggression and natural mortality causes including diseases influence park wolf populations more than disturbance from OSV use. However, in the first few years after wolves were reintroduced to the Lamar Valley in 1995 and 1996, there was little inter-species competition due to the low total number of wolves in the park and large unoccupied territories containing ample available prey species, so it is unknown how OSV use affected population growth. Additionally, wolf hunting success data suggests that wolves are more likely to successfully bring down an elk in areas that are flat, open, and near roads (Creel and Winnie 2005). Such data suggest that avoidance of such areas by wolves during the day, due to OSV use, may limit their hunting success, in turn increasing energy expenditure and mortality and reproductive success. Also the levels of use under alternative 2 could result in some increases in glucocorticoid levels, indicating increased stress, which could eventually affect reproductive and survival rates of this species; however, chronic elevations that result in decreased reproductive survival rates of this species are unlikely. Therefore, population-level impacts under alternative 2 are predicted to be long-term negligible to minor adverse.

The impacts described above would be mitigated under this alternative through several measures. If NPS monitoring indicates that human presence or activities are having unacceptable effects on wolves that cannot be otherwise mitigated, selected areas of the park (including sections of roads) may be closed to visitor use. Additionally, areas within a 1-mile radius of a wolf den are closed to public entry and many of the wolf dens are already within grizzly bear spring closure areas, which are protected from human disturbance.

Cumulative Effects

Impacts on wolves from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The minor adverse effects of these actions, when combined with the short and long-term negligible to minor adverse impacts of alternative 2, would result in long-term minor adverse cumulative impacts on wolves. Alternative 2 would contribute a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 2 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to current use levels, which would reduce the frequency of OSV encounters, and limit the duration of interaction and the approach distance of OSV users due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 2 would contribute a small amount to the overall adverse cumulative impacts.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Displacement, Behavioral, and Physiological Effects

Alternative 3 would increase OSV use levels up to 720 guided snowmobiles and 78 guided snowcoaches per day. Winter road monitoring crews rarely observed behavioral responses by wolves to OSVs in Yellowstone due to infrequent encounters, with a total of only 14 sightings of wolf-OSV interaction over the last seven winter monitoring seasons. Generally responses by wolves are either look-resume or no visible response (McClure et al. 2009), as described under alternative 2.

Wolves appear to avoid interaction with OSV users, but there is no evidence from wolf territories in the park of large-scale displacement or habitat avoidance (Smith et al. 2005). Observations of habitat use by radio-collared wolves indicate that wolves frequently travel in the Madison-Firehole-Gibson basin during Winter OSV use, but avoid areas of human activity, during the day. Wolf tracks were frequently observed on roads at night, suggesting that wolves travel on roads at night to conserve energy, but avoid OSV activity during the day (Smith et al. 2005; Smith et al. 2006). Frequent exposure to humans may result in habituation by wolves, resulting in possible lethal removal if wolves lose fear of humans and begin to engage in problematic behaviors such as approaching humans or chasing visitors (Smith et al. 2010), but such behaviors have not been attributed to winter OSV users following establishment of guiding requirements, which effectively eliminate problematic human behaviors such as feeding wolves or the dumping food scraps.

Under alternative 3 the frequency and duration of OSV presence in the park would increase, and wolves would need to spend more time avoiding encounters with OSVs, possibly affecting their normal routes of travel and causing small-scale displacement. Physiological responses would likely be increased with increased numbers of OSVs in the park. Therefore, impacts of alternative 3 would be localized short-term minor adverse.

Population-level Effects

Wolf populations in the park have grown during periods of similar OSV use similar to that which would occur under alternative 3 (daily averages of 700-800 snowmobiles/day), and data suggest that inter-species aggression and natural causes influence park wolf populations more than OSV use, as described under alternative 2. Such data suggest that avoidance of areas by wolves during the day due to OSV use may limit their hunting success, in turn increasing energy expenditure and mortality and reducing reproductive success. Also, the levels of use under alternative 3 could result in increased in glucocorticoid levels, indicating increased stress, but there is no evidence of population-level effects. Therefore, population-level impacts under alternative 3 are predicted to be long-term minor adverse.

Cumulative Effects

Impacts on wolves from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The minor adverse effects of these actions, when combined with the short- and long-term minor adverse impacts of alternative 3, would result in long-term minor adverse cumulative impacts on wolves. Alternative 3 would contribute a noticeable amount to the overall adverse cumulative impacts due to the increased level of ORV use permitted.

Conclusion

Alternative 3 would result in short- and long-term minor adverse impacts on wolves in the park because OSV use would increase the frequency and duration of OSV exposure. The guiding requirement regulates the interaction time and approach distance of OSV users, limiting adverse impacts from direct interaction. Cumulative impacts would be long-term minor adverse, and alternative 3 would contribute a noticeable amount to the overall adverse cumulative impacts.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Displacement, Behavioral, and Physiological Effects

Alternative 4 would implement winter use levels of up to 110 guided snowmobiles, 30 guided snowcoaches, and 100 guided wheeled buses on the roads from the north and west entrances to Old Faithful per day. Use at these levels would result in a total of 240 motorized vehicles in the park per day, which would be lower than the total number of vehicles allowed in the park currently. Roads may adversely affect wolf movements, dispersal, and general use of an area; however, plowed roads and use of buses rather than OSVs would have similar impacts to guided snowcoaches. The lower number of motorized vehicles in the park would correlate with lower glucocorticoid levels and reduced stress and associated adverse effects. Therefore, it is expected that the lower levels of motorized vehicle use proposed under alternative 4 would minimally elevate glucocorticoid levels, potentially resulting in minor long-term adverse effects on immune function and body condition (Sapolsky 1992).

Wolves appear to avoid interaction with OSV users, and would likely also avoid wheeled commercial vehicles (such as vans and buses), but there is no evidence from wolf territories in the park of large-scale displacement or habitat avoidance (Smith et al. 2005). Observations of habitat use by radio-collared wolves indicate that wolves frequently travel in the Madison-Firehole-Gibson basin during Winter OSV use, but avoid areas of human activity during the day. Wolf tracks were frequently observed on roads at night, suggesting that wolves travel on roads at night to conserve energy, but avoid OSV activity during the day (Smith et al. 2005; Smith et al. 2006). Frequent exposure to humans may result in habituation by wolves, resulting in possible lethal removal if wolves lose fear of humans and begin to engage in problematic behaviors such as approaching humans or chasing visitors (Smith et al. 2010). Such habituation behaviors by wolves have not been attributed to OSV visitors, following establishment of guiding requirements which effectively eliminate problematic human behaviors such as feeding wolves or the dumping food scraps

Under alternative 4 the frequency and duration of motorized vehicle presence in the park would decrease, and wolves would need to spend less time avoiding encounters with OSVs, resulting in only small-scale displacement. Physiological responses would decrease with lower numbers of motorized users in the park. Therefore, impacts would be localized, short-term negligible to minor adverse.

Population-level Effects

Wolf populations in the park have grown during periods of much higher OSV use than that which would occur under alternative 4 (daily averages of 795 snowmobiles/day), and data suggest that inter-species aggression and natural causes influence park wolf populations more than OSV use, as described under alternative 2. Such data suggest that avoidance of such areas by wolves during the day, due to OSV use, may limit their hunting success, in turn increasing energy expenditure and mortality and reducing reproductive success. Also, it is likely that the levels of use under alternative 4 would result in some increases in glucocorticoid levels, indicating increased stress; however, it is unlikely that chronic elevations would eventually decrease reproductive and survival rates of this species. Therefore, population-level impacts under alternative 4 are predicted to be long-term negligible to minor adverse.

Cumulative Effects

Impacts on wolves from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The minor adverse effects of these actions, when combined with the short and long-term negligible to minor adverse impacts of alternative 4, would result in long-term minor adverse cumulative impacts on wolves. Alternative 4 would contribute a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 4 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because motorized vehicle use would be limited to low use levels, which would reduce the frequency of motorized vehicle encounters with wolves, and limits duration and approach distance of OSV users when encountering wolves due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 4 would contribute a small amount to the overall adverse cumulative impacts.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Displacement, Behavioral, and Physiological Effects

Alternative 5 would potentially reduce OSV use levels to 120 guided snowcoaches per day, after a five-year phase out of snowmobiles. Prior to this phase out the impacts of alternative 5 would be the same as alternative 2. Depending on user-demand, the phase out may in anywhere from 78 guided snowcoaches and 318 guided snowmobiles per day to 120 snowcoaches and zero snowmobiles per day. If the five year phase out is completed, lower use levels of 120 guided snowcoaches and zero snowmobiles per day would limit the frequency and duration of OSV presence in the park, and would minimally elevate glucocorticoid levels, potentially resulting in few long-term adverse effects on immune function and body condition (Sapolsky 1992).

Wolves appear to avoid interaction with OSV users, but there is no evidence from wolf territories in the park of large-scale displacement or habitat avoidance (Smith et al. 2005). Observations of habitat use by radio-collared wolves indicate that wolves frequently travel in the Madison-Firehole-Gibson basin during Winter OSV use, but avoid areas of human activity, during the day. Wolf tracks were frequently observed on roads, suggesting that wolves travel on roads at night or when OSVs are not present to conserve energy, but avoid OSV activity during the day, indicating that displacement is short term and directly results from OSV presence (Smith et al. 2005; Smith et al. 2006). Frequent exposure to humans may result in habituation by wolves, resulting in possible lethal removal if wolves lose fear of humans and begin to engage in problematic behaviors such as approaching humans or chasing visitors (Smith et al. 2010). Such habituation behaviors by wolves have not been attributed to OSV visitors following establishment of guiding requirements.

Under alternative 5 the frequency and duration of motorized vehicle presence in the park would decrease to relatively low levels, and wolves would need to spend less time avoiding encounters with OSVs, resulting in only small-scale, temporary displacement. Physiological responses would decrease with lower numbers of motorized users in the park. Therefore, impacts would be localized, short-term negligible to minor adverse.

Population-level Effects

Wolf populations in the park have grown during periods of much higher OSV use than that which would occur under alternative 5 (daily averages of 795 snowmobiles per day), and data suggest that inter-species aggression and natural causes influence park wolf populations more than OSV use, as described under alternative 2. Such data suggest that avoidance of such areas by wolves during the day due to OSV use may limit their hunting success, in turn increasing energy expenditure and mortality and reducing reproductive success. Also, it is likely that the levels of use under alternative 5 would result in some increases in glucocorticoid levels, indicating increased stress. However, chronic elevations that would result in decreased reproductive survival rates of this species are unlikely. Therefore, population-level impacts under alternative 5 are predicted to be long-term negligible adverse.

Cumulative Effects

Impacts on wolves from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The minor adverse effects of these actions, when combined with the short and long-term negligible to minor adverse impacts of alternative 5, would result in long-term minor adverse cumulative impacts on wolves. Alternative 5 would contribute a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 5 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to low use levels which reduces the frequency of motorized vehicle encounters with wolves, and limits duration and approach distance of OSV users when encountering wolves due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 5 would contribute a small amount to the overall adverse cumulative impacts.

Impacts of Alternative 6: Implement Variable Management

Displacement, Behavioral, and Physiological Effects

Alternative 6 would allow for variable use levels of up to 540 snowmobiles and 78 snowcoaches per day and variable entrance allocations, and would allow 25% of snowmobiles entering the park to be unguided. Unguided snowmobile use would increase the amount of OSV traffic in the park, and the level of behavioral responses by wolves. This is because unguided snowmobile users are more likely to engage in behaviors that cause increased behavioral responses, displacement, and associated physiological effects, such as traveling at high rates of speed and improper interactions with wildlife, as observed in unguided user interactions with other species during past winter use seasons (White et al. 2008). Frequent exposure to humans may result in habituation by wolves, resulting in possible lethal removal if wolves lose fear of humans and begin to engage in problematic behaviors such as approaching humans or chasing visitors (Smith et al. 2010). Such habituation behaviors by wolves have not been attributed to OSV visitors, following establishment of guiding requirements which effectively eliminate problematic human behaviors such as feeding wolves or the dumping food scraps. However, the unguided/non-commercially guided alternative may increase problematic behaviors by human visitors, due to lack of trained commercial guides and regulation on proper wildlife interaction behavior, and careful storage and disposal of food. Behavioral observations of wildlife also indicate that larger OSV group sizes, such as those allowed under alternative 6, increase behavioral and associated physiological responses in wildlife. Under alternative 6 the increase in OSV use and the unguided entry provision may increase displacement of wolves from area of OSV use. Also, the increased levels of disturbance from more frequent OSV presence on snow roads, larger group sizes, and activities of unguided users (such as off-road travel or high rates of speed) may increase behavioral responses by wolves. Therefore, impacts would be localized, short-term minor to moderate adverse.

Population-level Effects

Wolf populations in the park have grown during periods of higher OSV use than those that would occur under alternative 6 (daily averages of 795 snowmobiles/day), and data suggest that inter-species aggression and natural causes influence park wolf populations more than OSV use, as described under alternative 2. Such data suggest that avoidance of such areas by wolves during the day, due to OSV use, may limit their hunting success, in turn increasing energy expenditure and mortality and reducing reproductive success. Chronic elevations that would result in decreased reproductive survival rates of this species are unlikely. Therefore, population-level impacts under alternative 6 are predicted to be long-term minor adverse.

Cumulative Effects

Impacts on wolves from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The minor adverse effects of these actions, when combined with the short and long-term minor to moderate adverse impacts of alternative 6, would result in long-term minor to moderate adverse cumulative impacts on wolves. Alternative 6 would contribute a noticeable amount to the overall adverse cumulative impacts.

Conclusion

Alternative 6 would result in long-term minor to moderate adverse impacts on wolves in the park because OSV use would increase to relatively high use levels, which would increase the frequency of OSV encounters with wolves and the duration of OSV presence. The unguided snowmobile provision may result in improper behavior and decreased approach distance of OSV users when encountering wolves. Cumulative impacts would be long-term minor to moderate adverse and alternative 6 would contribute a noticeable amount to the overall adverse cumulative.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Displacement, Behavioral, and Physiological Effects

Alternative 7 would continue use levels similar to the 2009 interim rule (330 guided snowmobiles and 80 guided snowcoaches per day). Winter road monitoring crews rarely observed behavioral responses by wolves to OSVs in Yellowstone, due to infrequent encounters, with a total of only 14 sightings of wolf-OSV interaction over the last 7 winter monitoring seasons. Generally responses by wolves are either look-resume or no visible response (McClure et al. 2009). The levels of use under alternative 3 could result in increased glucocorticoid levels, indicating increased stress, but there is no evidence of population-level effects. Also, frequent exposure to humans may result in habituation by wolves, resulting in possible lethal removal if wolves lose fear of humans and begin to engage in problematic behaviors such as approaching humans or chasing visitors (Smith et al. 2010).

Wolves appear to avoid interaction with OSV users, but there is no evidence from wolf territories in the park of large-scale displacement or habitat avoidance (Smith et al. 2005). Observations of habitat use by radio-collared wolves indicate that wolves frequently travel in the Madison-Firehole-Gibson basin during Winter OSV use, but avoid areas of human activity during the day. Wolf tracks were frequently observed on roads at night, suggesting that wolves travel on roads at night to conserve energy but avoid OSV activity during the day (Smith et al. 2005; Smith et al. 2006). It appears that wolves avoid encounters with OSVs and maintain normal travel activities in the park. Wolves may travel on roads to conserve energy, but they do not appear to follow roads for long distances, or to areas they would not frequent otherwise. Physiological responses would likely be increased with increased numbers of OSVs in the park, but guiding requirements and use limits under alternative 7 would limit these responses. Because wolves rarely travel on OSV routes during the day, the addition of the 10:30 cut-off time, and variable use limits under alternative 7 would have minimal influence on wolves. Therefore, impacts under alternative 7 would be localized, short-term negligible to minor adverse.

Population-level Effects

Wolf populations in the park have grown during periods of much higher OSV use than that which occurs under current conditions (daily averages of 795 snowmobiles/day) and data suggest that inter-species aggression and natural causes including diseases influence park wolf populations more than disturbance from OSV use. However, in the first few years after wolves were reintroduced, there was little inter-species competition due to the low total number of wolves in the park and large unoccupied territories containing ample available prey species, so it is unknown how OSV use affected population growth. Additionally, wolf hunting success data suggests that wolves are more likely to successfully bring down an elk in areas that are flat, open, and near roads (Creel and Winnie 2005). Such data suggest that avoidance of such areas by wolves during the day, due to OSV use, may limit their hunting success, in turn increasing energy expenditure and mortality and reducing reproductive success. Also the levels of use under alternative 7 could result in some increases in glucocorticoid levels, indicating increased stress, which could eventually affect reproductive and survival rates of this species, however chronic elevations that result in decreased reproductive survival rates of this species are unlikely. Therefore, population-level impacts under alternative 7 are predicted to be long-term negligible to minor adverse.

Cumulative Effects

Impacts on wolves from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The minor adverse effects of these actions, when combined with the short and long-term negligible to minor adverse impacts of alternative 7, would result in long-term minor adverse cumulative impacts on wolves. Alternative 7 would contribute a small amount to the overall adverse cumulative impacts.

Conclusion

Alternative 7 would result in short- and long-term negligible to minor adverse impacts on wolves in the park because OSV use would be limited to current use levels, which would reduce the frequency of OSV encounters and limit the duration and approach distance of OSV users due to guiding requirements. Cumulative impacts would be long-term minor adverse, and alternative 7 would contribute a small amount to the overall adverse cumulative impacts.

AIR QUALITY

GUIDING REGULATIONS AND POLICIES

In compliance with the 1970 Clean Air Act (CAA) and the 1977 and 1990 CAA Amendments, the U.S. Environmental Protection Agency (EPA) has promulgated National Ambient Air Quality Standards (NAAQS) and regulations. The standards were enacted for the protection of the public health and welfare, allowing for an adequate margin of safety. To date, EPA has issued standards for six criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), particles with a diameter less than or equal to a nominal 10 micrometers (PM_{10}), particles with a diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb). Each state and locality has the primary responsibility for air pollution prevention and control. Areas that do not meet national standards are called non-attainment areas. Refer to "Chapter 3: Affected Environment" for more information on each of the criteria pollutants and associated NAAQS.

In addition to the CAA, air quality is also addressed in NPS *Management Policies 2006*. The *NPS Management Policies 2006* state that NPS will "seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas" (NPS 2006a; Section 4.7.1). NPS *Management Policies 2006* further state that the NPS will assume an aggressive role in promoting and pursuing measures to protect air quality related values from the adverse impacts of air pollution.

Pollutant concentrations at or above the NAAQS are not the expected natural condition for a park and could result in a non-attainment designation for a park unit, reflecting unacceptable and polluted air. However, pollutant concentrations below the NAAQS can also affect human health, particularly in sensitive individuals. Therefore, NPS addresses the potential for air quality impacts when pollutant concentrations are below the NAAQS through intensity definitions established in the Technical Guidance on Assessing Impacts to Air Quality in NEPA and Planning Documents (NPS 2011).

METHODOLOGY

This section provides an overview of the major components of the air quality analysis methodology. For detailed technical information on the development of emissions factors, background concentrations and other modeling assumptions, refer to appendix B.

Criteria Pollutant Concentrations

The park, in consultation with the NPS Air Resources Division, selected four locations for air quality modeling based on OSV traffic levels. To help compare and contrast different levels of OSV use, the sites were selected to include those areas where the highest pollutant concentrations would be expected and to represent a range of OSV activity levels. The four locations selected for modeling are the west entrance, the west entrance to Madison Junction Road, the Old Faithful staging area, and the Canyon to Fishing Bridge road.

Maximum predicted ambient concentrations of CO, NO_2 and PM_{10} and $PM_{2.5}$ were calculated for each location using EPA-approved air quality models (CAL3QHCR and AERMOD). Impacts for each alternative were assessed with respect to the NAAQS and the 1-hour CO state standard in Montana, which is 23 parts per million (ppm) (compared to the 1-hour CO NAAQS of 35 ppm). The estimates of maximum CO, NO_2, PM_{10} and $PM_{2.5}$ concentrations generated by OSVs take into account emissions data, meteorological phenomena, vehicle traffic/travel conditions, and the physical configurations of roadways and staging areas.

Emissions Inventory

In addition to the modeling analysis for determining potential short-term CO, NO_2, and particulate concentrations, an emissions inventory for criteria pollutants (CO, particulate matter (PM), and NO_x) and hydrocarbons (HC) in tons per winter season was completed for each alternative. An emissions inventory of hazardous air pollutants (HAPs) (benzene; 1-3 butadiene; formaldehyde; and acetaldehyde) was also completed. Emissions were calculated using travel estimates of OSVs and on-road (wheeled) vehicles used on Yellowstone roadways, the roadway lengths, and the modes of operation of the vehicles. Emission factors were combined with daily vehicle traffic levels for each roadway segment for each alternative to determine total parkwide emissions for each pollutant. The winter season was defined as a 90-day period running from mid-December to mid-March.

Because Yellowstone is classified as a federal Class I area, PM_{10} increment comparisons under prevention of significant deterioration (PSD) increments were assessed. PSD increments are the maximum permitted increases in pollutant concentrations over baseline levels for PM_{10}. For Class I areas, the PM_{10} PSD increments are 4 and 8 micrograms per cubic meter for the annual and 24-hour averaging periods, respectively. Winter OSV emissions were considered increment consuming or contributing sources for this analysis. The analysis assessed PSD increments for the 24-hour averaging period only, since the sources of concern are only present during the winter season and an annual average would not be applicable. This assessment is a screening level approach and may indicate that a detailed analysis is required if concentrations are near the PM_{10} PSD increments. Furthermore, because the methodology employed in this analysis is a screening-level analysis, it is not intended for regulatory purposes and does not constitute a regulatory PSD increment consumption analysis.

Visibility Impacts

As required by the visibility protection provision of the CAA, additional requirements apply when a proposed source has the potential to impair visibility in a Class I area (40 CFR 52.27 (d)), such as Yellowstone. Potential visibility impacts for each alternative were assessed using the EPA model VISCREEN.

Analysis Scenarios

Alternative 1 was not modeled because visitor OSV use would not be allowed under this alternative after the 2010/2011 winter season. Therefore, air quality would not be affected by visitor OSV use in the park. The air quality impacts of administrative OSV use under alternative 1 are anticipated to be negligible.

Alternatives 2, 3, and 4 were modeled based on the maximum allowed level of OSV use each day of the winter season as described in chapter 2. Under alternative 5, snowmobile use could be phased out over a five-year period and the number of BAT snowcoaches would increase. To understand the range of possibilities, two separate conditions were analyzed for alternative 5—one representing the start of the transition to BAT snowcoaches (alternative 5a), during which time snowmobiles would be allowed, and one representing condition of all BAT snowcoaches and no snowmobiles (alternative 5b). The modeling of alternative 5a assumes a 50/50 mix of BAT and non-BAT gasoline snowcoaches for the period before the 2014/2015 season when BAT requirements for snowcoaches would be fully implemented. Alternative 5a also provides an approximation of existing conditions (a mix of BAT and non-BAT snowcoaches and BAT snowmobile) if the current allocations were met every day of the winter season.

Under alternative 6, OSV levels would vary by creating times and places for higher and lower levels of use. Maximum pollutant concentrations under alternative 6 were modeled based on the maximum level of OSV use that would be allowed per day (up to 540 snowmobiles and 78 snowcoaches). Seasonal total emissions inventories for alternative 6 were modeled based on the seasonal average daily OSV use level (355 snowmobiles and 51 snowcoaches).

Alternative 7 proposes a variety of use levels, which would establish a maximum number of snowmobiles and snowcoaches permitted in the park for specific days throughout the winter season. Three different use levels for each vehicle type would be implemented and each of these use levels was modeled for air quality impacts. Snowmobile use would range from 132 to 330 vehicles per day and snowcoach use would range from 30 to 80 vehicles per day. Alternative 7a represents the highest OSV that would be permitted. Alternative 7b provides modeling results for medium OSV use level, and alternative 7c represents the lowest limits on OSV entry to the park.

Intensity Definitions

Concentrations at or above the NAAQS are not the expected natural condition for a park and could result in a non-attainment designation for a park unit, reflecting unacceptable and polluted air. However, pollutant concentrations below the NAAQS can also affect human health, particularly in sensitive individuals. The EPA has developed an Air Quality Index (AQI) that correlates criteria pollutant concentrations to associated health concern categories. The NPS used the AQI in combination with the policy relevant background (PRB) concentration for each pollutant to develop the air quality intensity definitions shown in table 39 (NPS 2011). The PRB concentration represents the natural background plus human pollution from transport outside North America. The air quality intensity definitions reflect the importance of maintaining excellent air quality in parks, not merely complying the NAAQS. Even concentrations at 80% of the NAAQS are considered a major impact.

TABLE 39: AIR QUALITY INTENSITY DEFINITIONS

Impact level	1-hr Carbon Monoxide (ppm)	8-hr Carbon Monoxide (ppm)	24-hr PM_{10} (μg/m^3)	24-hr $PM_{2.5}$ (μg/m^3)	1-hr Nitrogen Dioxide (ppm)
Negligible	0–0.2	0–0.2	0–11	0–5	0–0.001
Minor	0.3–17.5	0.3–4.4	12–77	6–20	0.002–0.049
Moderate	17.6–27.9	4.5–7.1	78–119	21–28	0.050–0.079
Major	28.0–35.0	7.2–9.0	120–150	29–35	0.079–0.100

Source: Technical Guidance on Assessing Impacts to Air Quality in NEPA and Planning Documents (NPS 2011).

A negligible impact is defined as the range of concentrations for each pollutant that is the highest estimated PRB concentration, as determined by EPA in its criteria pollutant documents and pollutant assessments. Concentrations in this range are indistinguishable from variations in the background concentrations that are of natural and long-range transport origin. The minor impact level follows the AQI scale and corresponds to concentrations from the PRB up to an additional 50% of the difference between the PRB and the NAAQS. The moderate impact level is from 51% to 79% of the NAAQS. The major impact level in table 39 corresponds to 80% to 100% of the NAAQS for each pollutant. EPA often uses 80% as a threshold warning for approaching the NAAQS.

Qualitative visibility impact thresholds are defined separately from the air quality definitions (see table 40).

TABLE 40: VISIBILITY INTENSITY DEFINITIONS

Impact level	Description
Negligible	No perceptible visibility impacts are likely (no visible smoke, plume, or haze).
Minor	Perceptible visibility impacts occur, but are only visible from a small area of the park, are of short duration (less than one day per year) and visible to only a few park visitors on the days that they occur.
Moderate	Perceptible visibility impacts occur and are visible from several areas of the park, occur between one and several days per year, and many park visitors may observe them on the days that they occur.
Major	Perceptible visibility impacts occur and are visible from many areas of the park, occur many days over the course of a year, or are visible to a majority of park visitors on the days that they occur.

Source: Technical Guidance on Assessing Impacts to Air Quality in NEPA and Planning Documents (NPS 2011).

Study Area

The study area for the assessment of the various alternatives is the park. The study area for the cumulative impacts analysis is the park plus the lands adjacent to the park boundaries.

Criteria Pollutant Concentrations

Tables 41 and 42 show the maximum predicted 1- and 8-hour average CO concentrations for each of the action alternatives. The modeling results indicate that winter use vehicle emissions would not result in any exceedance of the CO NAAQS, or the Montana, Wyoming, or Idaho ambient air quality standards, under any of the alternatives. The maximum predicted 1-hour CO concentrations are above background levels, but less than 50% of the difference between background levels and the NAAQS, resulting in minor impacts under any of the alternatives. Under alternatives 4, 5b, and 7c, the maximum predicted 8-hour CO concentrations are indistinguishable from background levels (negligible impacts). Under alternatives 2, 3, 4, 5a, 6, 7a, and 7b, the maximum predicted 8-hour CO concentrations are above background levels, but less than 50% of the difference between background levels and the NAAQS (minor impacts).

TABLE 41: MAXIMUM PREDICTED 1-HOUR CARBON MONOXIDE (CO) CONCENTRATIONS (IN PPM)

Alternative	Site 1: West Entrance 1-Hour (ppm)	Site 2: West Entrance to Madison 1-Hour (ppm)	Site 3: Canyon to Fishing Bridge 1-Hour (ppm)	Site 4: Old Faithful Staging Area 1-Hour (ppm)	Maximum Level of Air Quality Impact
Alternative 2: 2008 Plan Limits	1.0	0.4	0.3	0.3	Minor
Alternative 3: 2004 Plan Limits	1.8	0.7	0.3	0.4	Minor
Alternative 4: Mixed-Use	0.3	0.3	0.2	0.2	Minor
Alternative 5a Start: Transition to BAT Snowcoaches Only	1.2	0.5	0.3	0.4	Minor
Alternative 5b Final: Transition to BAT Snowcoaches Only	0.2	0.3	0.3	0.2	Minor
Alternative 6: Implement Variable Management	1.5	0.4	0.3	0.4	Minor
Alternative 7a: Provide a Variety of Use Levels and Experiences for Visitors (High)	1.5	0.4	0.3	0.3	Minor
Alternative 7b: Provide a Variety of Use Levels and Experiences for Visitors (Medium)	0.7	0.3	0.3	0.3	Minor
Alternative 7c: Provide a Variety of Use Levels and Experiences for Visitors (Low)	0.4	0.3	0.2	0.2	Minor

Note: The NAAQS for CO is 35 parts per million (ppm), for the 1-hour averaging period.

TABLE 42: MAXIMUM PREDICTED 8-HOUR CARBON MONOXIDE (CO) CONCENTRATIONS (IN PPM)

Alternative	Site 1: West Entrance 8-Hour (ppm)	Site 2: West Entrance to Madison 8-Hour (ppm)	Site 3: Canyon to Fishing Bridge 8-Hour (ppm)	Site 4: Old Faithful Staging Area 8-Hour (ppm)	Maximum Level of Air Quality Impact
Alternative 2: 2008 Plan Limits	0.4	0.2	0.3	0.2	Minor
Alternative 3: 2004 Plan Limits	0.6	0.3	0.2	0.2	Minor
Alternative 4: Mixed-Use	0.2	0.2	0.2	0.2	Negligible
Alternative 5a Start: Transition to BAT Snowcoaches Only	0.5	0.3	0.2	0.2	Minor
Alternative 5b Final: Transition to BAT Snowcoaches Only	0.2	0.2	0.2	0.2	Negligible
Alternative 6: Implement Variable Management	0.5	0.3	0.2	0.2	Minor
Alternative 7a: Provide a Variety of Use Levels and Experiences for Visitors (High)	0.4	0.2	0.2	0.2	Minor
Alternative 7b: Provide a Variety of Use Levels and Experiences for Visitors (Medium)	0.3	0.2	0.2	0.2	Minor
Alternative 7c: Provide a Variety of Use Levels and Experiences for Visitors (Low)	0.2	0.2	0.2	0.2	Negligible

Note: The NAAQS for CO is 9 parts per million (ppm), for the 8-hour averaging period.

Table 43 shows the maximum predicted 1-hour NO_2 concentrations for each of the action alternatives. For all alternatives, the modeling results indicate that the maximum 1-hour NO_2 concentrations would be below the NAAQS and the Montana ambient air quality standards. For all alternatives, the predicted maximum NO_2 concentrations would fall into the minor impacts category (above background levels, but less than 50% of the difference between background levels and the NAAQS). NO_2 concentrations would be the highest at the west entrance under alternatives 6 and 7a (0.032 ppm), and the lowest overall under alternatives 4 and 7c (0.001 to 0.010 ppm depending and the location and alternative).

TABLE 43: MAXIMUM PREDICTED 1-HOUR NITROGEN DIOXIDE (NO_2) CONCENTRATIONS (IN PPM)

Alternative	Site 1: West Entrance 1-Hour (ppm)	Site 2: West Entrance to Madison 1-Hour (ppm)	Site 3: Canyon to Fishing Bridge 1-Hour (ppm)	Site 4: Old Faithful Staging Area 1-Hour (ppm)	Maximum Level of Air Quality Impact
Alternative 2: 2008 Plan Limits	0.027	0.017	0.016	0.001	Minor
Alternative 3: 2004 Plan Limits	0.027	0.030	0.017	0.001	Minor
Alternative 4: Mixed-Use	0.010	0.005	0.007	0.002	Minor
Alternative 5a Start: Transition to BAT Snowcoaches Only	0.020	0.018	0.011	0.001	Minor
Alternative 5b Final: Transition to BAT Snowcoaches Only	0.019	0.010	0.010	0.001	Minor
Alternative 6: Implement Variable Management	0.032	0.024	0.014	0.001	Minor
Alternative 7a: Provide a Variety of Use Levels and Experiences for Visitors (High)	0.032	0.018	0.011	0.001	Minor
Alternative 7b: Provide a Variety of Use Levels and Experiences for Visitors (Medium)	0.029	0.012	0.008	0.001	Minor
Alternative 7c: Provide a Variety of Use Levels and Experiences for Visitors (Low)	0.008	0.007	0.005	0.001	Minor

Note: The NAAQS for NO_2 is 0.100 parts per million (ppm), for the 1-hour averaging period.

Table 44 shows the maximum predicted 24-hour $PM_{2.5}$ concentrations for each of the alternatives. The modeling results indicate that no winter use vehicle emissions from any of the alternatives would result in exceedances of the 24-hour $PM_{2.5}$ NAAQS, or the Montana, Idaho or Wyoming ambient air quality standards. Under all alternatives, 24-hour $PM_{2.5}$ concentrations would be in the range of background concentrations (negligible impacts).

TABLE 44: MAXIMUM PREDICTED 24-HOUR $PM_{2.5}$ CONCENTRATIONS (IN μG/M^3)

Alternative	Site 1: West Entrance 24-Hour μg/m^3	Site 2: West Entrance to Madison 24-Hour μg/m^3	Site 3: Canyon to Fishing Bridge 24-Hour μg/m^3	Site 4: Old Faithful Staging Area 24-Hour μg/m^3	Maximum Level of Air Quality Impact
Alternative 2: 2008 Plan Limits	1.9	1.5	1.4	1.5	Negligible
Alternative 3: 2004 Plan Limits	2.5	1.5	1.5	1.5	Negligible
Alternative 4: Mixed-Use	2.1	2.4	1.4	1.5	Negligible
Alternative 5a Start: Transition to BAT Snowcoaches Only	1.9	1.4	1.4	1.5	Negligible
Alternative 5b Final: Transition to BAT Snowcoaches Only	1.4	1.5	1.4	1.4	Negligible
Alternative 6: Implement Variable Management	2.2	1.5	1.4	1.5	Negligible
Alternative 7a: Provide a Variety of Use Levels and Experiences for Visitors (High)	1.9	1.5	1.4	1.5	Negligible
Alternative 7b: Provide a Variety of Use Levels and Experiences for Visitors (Medium)	1.6	1.4	1.4	1.4	Negligible
Alternative 7c: Provide a Variety of Use Levels and Experiences for Visitors (Low)	1.5	1.4	1.4	1.4	Negligible

Note: The NAAQS for $PM_{2.5}$ is 35 micrograms per cubic meter (μg/m^3), for the 24-hour averaging period.

Prevention of Significant Deterioration Increment Analysis

Since Yellowstone is a Class I area, PM_{10} PSD increment consumption was assessed. For Class I areas, the PM_{10} PSD increment is 8 micrograms per cubic meter for the 24-hour averaging period, which the EPA has determined to be the smallest "allowable" incremental increase for PM_{10} in these areas. This increment is evaluated in reference to the previously established baseline date of 1979 for Yellowstone (NPS 2000c), which was used to determine baseline concentrations. For this study, a screening level approach was employed in comparing predicted PM_{10} increments (no background contribution) with estimated 1979 baseline concentrations to determine the increment for the alternatives.

Snowmobile traffic in the park increased from 1979 until the early 2000s and then decreased to levels less than the late 1970s, whereas snowcoach travel has seen a steady increase, almost doubling in 10 years. It is expected that the BAT snowmobiles required by the proposed alternatives would generally result in a net decrease in 24-hour PM_{10} levels compared to the established baseline data. The 1979 baseline levels were estimated as part of the 2007 Yellowstone Winter Use Plan FEIS. The methodology used to develop the 1979 baseline levels involved adjusting 1999 Historical Conditions

Scenario modeled PM_{10} levels based on the maximum daily snowmobile levels (from Yellowstone entry records) for 1979 and 1999. Because the methodology employed in this study is a screening-level analysis, it is not intended for regulatory purposes and does not constitute a regulatory PSD increment consumption analysis. Typically, detailed analysis would be required if concentrations are near or "consume" the allowable Class I PM_{10} PSD increment.

The predicted 24-hour PM_{10} PSD increment consumption values, based on the previously described particulate modeling are shown in table 45 for each of the action alternatives. The PSD increment is below the applicable PSD increment threshold of 8 micrograms per cubic meter for all alternatives and analysis sites. Therefore, further detailed analysis of PM_{10} increment consumption is not required.

TABLE 45: 24-HOUR PM_{10} PSD INCREMENT CONSUMPTION IN MICROGRAMS PER CUBIC METER ($\mu g/m^3$)

Alternative	Site 1: West Entrance	Site 2: West Entrance to Madison	Site 3: Canyon to Fishing Bridge	Site 4: Old Faithful Staging Area
Alternative 2: 2008 Plan Limits	0.5	0.1	0.0	0.1
Alternative 3: 2004 Plan Limits	1.1	0.1	0.1	0.1
Alternative 4: Mixed-Use	0.7	1.0	0.0	0.1
Alternative 5a Start: Transition to BAT Snowcoaches Only	0.5	0.0	0.0	0.1
Alternative 5b Final: Transition to BAT Snowcoaches Only	0.0	0.1	0.0	0.0
Alternative 6: Implement Variable Management	0.8	0.1	0.0	0.1
Alternative 7a: Provide a Variety of Use Levels and Experiences for Visitors (High)	0.5	0.1	0.0	0.1
Alternative 7b: Provide a Variety of Use Levels and Experiences for Visitors (Medium)	0.2	0.0	0.0	0.0
Alternative 7c: Provide a Variety of Use Levels and Experiences for Visitors (Low)	0.1	0.0	0.0	0.0
1999 Historical Unregulated Scenario	191.5	40.2	5.9	3.8
PSD Baseline Year: 1979 Historical Condition	42.5	8.9	1.1	0.7

Note: Baseline Year concentrations are based on the ratio of 1979 to 1999 snowmobile levels at the modeling locations. Class I PSD Increment for 24-hour average PM_{10} is 8 $\mu g/m^3$.

Emissions Inventory

The total maximum potential winter season emissions in the park in tons per winter season are shown for each action alternative in table 46. To help put the emissions inventory in perspective, annual emissions information for the year 2000 is also presented. Over time, Yellowstone has continued to progress in a variety of non-winter-related emission areas, including more widespread use of bio-based fuels for both administrative and visitor vehicles, use of more hybrid and alternative fueled administrative vehicles, improvements in underground fuel storage tanks, and increased use of four-stroke marine engines. Also, the park has reduced residential woodstoves (often replaced by propane) and converted some stationary sources that relied on fuel oil to propane. Thus, the non-OSV emissions component is most likely lower in 2010 than the 2000 estimate (NPS 2007c).

TABLE 46: PARKWIDE TOTAL WINTER SEASON MOBILE SOURCE EMISSIONS IN POUNDS PER DAY (LB/DAY) AND TONS PER YEAR (TPY)

Alternative	Carbon Monoxide (CO)		Hydrocarbon (HC)		Nitrogen Oxide (NO_x)		Particulates (PM)	
	lb/day	tpy	lb/day	tpy	lb/day	tpy	lb/day	tpy
Alternative 2: 2008 Plan Limits	1,952	88	93	4.16	619	28	5	0.2
Alternative 3: 2004 Plan Limits	2,992	135	166	7.48	947	43	7	0.3
Alternative 4: Mixed-Use	1,177	53	64	2.90	345	16	201	9.0
Alternative 5a Start: Transition to BAT Snowcoaches Only	3,809	171	108	4.85	690	31	4	0.2
Alternative 5b Final: Transition to BAT Snowcoaches Only	1,540	69	41	1.86	489	22	4	0.2
Alternative 6: Implement Variable Management	1,663	75	88	3.94	527	24	4	0.2
Alternative 7 Provide a Variety of Use Levels and Experiences for Visitors	1,998	73	95	3.53	633	23	5	0.2
Yellowstone Annual Emissions (circa 2000)		6,662		-------		297		212

Notes: Annual Emissions for 2000 are from the 2000 Air Emissions Inventory, Yellowstone National Park (final March 2003) (NPS 2003b). Includes summer and winter point, area, and mobile sources (excluding wildfire).

The report inventoried volatile organic compounds (VOCs) but not HC. The report is available a http://www2.nature.nps.gov/air/AQBasics/inparkemissions.cfm.

Alternative 7 daily emissions based on the maximum use level (alternative 7a).

Total CO emissions are estimated to be the highest under alternative 5a, which includes some non-BAT snowcoaches. HC and NO_x emissions would be the highest under alternative 3, the alternative with the highest OSV entrance volumes. PM emissions would be substantially higher under alternative 4 compared to other alternatives because of the emissions associated with fugitive dust on plowed roads.

Hazardous Air Pollutant Emissions

Total winter season mobile source emissions of HAPs for the action alternatives are summarized in table 47. HAP emissions, such as benzene, would be highest under alternative 3 and lowest under alternative 5b.

TABLE 47: PARKWIDE TOTAL WINTER SEASON MOBILE SOURCES HAPS EMISSIONS (TONS PER YEAR)

Alternative	Benzene (tpy)	1-3 Butadiene (tpy)	Formaldehyde (tpy)	Acetaldehyde (tpy)
Alternative 2: 2008 Plan Limits	0.11	0.00	0.12	0.04
Alternative 3: 2004 Plan Limits	0.20	0.00	0.21	0.08
Alternative 4: Mixed-Use	0.08	0.01	0.09	0.03
Alternative 5a Start: Transition to BAT Snowcoaches Only	0.14	0.01	0.12	0.04
Alternative 5b Final: Transition to BAT Snowcoaches Only	0.06	0.01	0.05	0.02
Alternative 6: Implement Variable Management	0.11	0.00	0.11	0.04
Alternative 7 Provide a Variety of Use Levels and Experiences for Visitors	0.10	0.00	0.10	0.04

Notes: Four-stroke snowmobile HAPs estimated as a fraction of measured HC emissions based on data reported in SwRI's Laboratory Testing of Snowmobile Emissions, Lela and White, July 2002.

Snowcoach and on-road vehicle HAPs estimated as a fraction of HC emissions based on MOBILE6.2 modeling of HC and air toxics emission factors for light- and heavy-duty vehicles.

Visibility

The results of the VISCREEN modeling are shown in table 48. No potential localized, perceptible, visibility impacts are predicted for any of the action alternatives.

TABLE 48: VISIBILITY SCREENING IMPACTS

Alternative	Screening Criteria Exceedance			
	Site 1: West Entrance	Site 2: West Entrance to Madison	Site 3: Canyon to Fishing Bridge	Site 4: Old Faithful Staging Area
Alternative 2: 2008 Plan Limits	No	No	No	No
Alternative 3: 2004 Plan Limits	No	No	No	No
Alternative 4: Mixed-Use	No	No	No	No
Alternative 5a Start: Transition to BAT Snowcoaches Only	No	No	No	No
Alternative 5b Final: Transition to BAT Snowcoaches Only	No	No	No	No
Alternative 6: Implement Variable Management	No	No	No	No
Alternative 7a: Provide a Variety of Use Levels and Experiences for Visitors (High)	No	No	No	No
Alternative 7b: Provide a Variety of Use Levels and Experiences for Visitors (Medium)	No	No	No	No
Alternative 7c: Provide a Variety of Use Levels and Experiences for Visitors (Low)	No	No	No	No

SUMMARY OF IMPACTS

This section summarizes the impact analysis results for each alternative, discusses cumulative effects, and provides conclusions regarding the effects of each alternative on air quality and visibility. The air quality impacts for each alternative are representative of the maximum level of impact that could occur from emissions of CO, NO_2 and $PM_{2.5}$. This section is followed by the detailed impact analysis of each alternative.

Alternative 1 would have long-term negligible adverse impacts to air quality and visibility because OSV use by visitors would not be allowed. OSV traffic levels would be zero into the future and the only emissions would be from minimal administrative OSV use.

- Alternative 2 would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.0 ppm, 0.4 ppm, and 0.027 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely, resulting in long-term negligible adverse impacts.
- Alternative 3 would result in long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.8 ppm, 0.6 ppm, and 0.027 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely, resulting in long-term negligible adverse impacts.
- Alternative 4 would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO and NO_2 concentrations of 0.3 ppm and 0.010 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely, resulting in long-term negligible adverse impacts.
- Alternatives 5a and 5b would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.2 ppm, 0.5 ppm, and 0.020 ppm, respectively (5a) and predicted maximum 1-hour CO and NO_2 concentrations of 0.3 ppm and 0.019 ppm, respectively (5b). Air quality would improve with the completion of the transition to BAT snowcoaches. No perceptible visibility impacts would be likely under alternative 5 before, during, or after the transition to BAT snowcoaches.
- Alternative 6 would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.5 ppm, 0.5 ppm, and 0.032 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely, resulting in long-term negligible adverse impacts. These indicators were based on the highest use day, 540 snowmobiles and 78 snowcoaches; therefore, days when OSV use levels are lower, these impacts would be expected to decrease.
- Impacts to air quality under alternative 7 would vary day-to-day based on the level of OSV use allowed. However, the overall air quality impact conclusion for alternative 7 is the same regardless of the level of use—long-term minor adverse impacts. Under alternative 7a, the minor adverse impacts would be due to the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.5 ppm, 0.4 ppm, and 0.032 ppm, respectively. Under alternative 7b, the minor adverse impacts would be due to the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 0.7 ppm, 0.3 ppm, and 0.029 ppm, respectively. Under alternative 7c, the minor adverse impacts would be due to the predicted maximum 1-hour CO and NO_2 concentrations of 0.4 ppm and 0.008 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely.

DETAILED IMPACT ANALYSIS

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Under alternative 1, air quality and visibility impacts would be long-term negligible adverse because OSV use by visitors would not be allowed. The current visitor OSV traffic levels under the 2009 interim rule would be zero into the future and the only emissions would be from administrative OSV use.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that have the potential to impact air quality are summarized below. Substantial impacts to air quality and visibility in the park are not expected due to the protections granted under the CAA as a Class I area. The impacts of past, present, and reasonably foreseeable future actions, combined with the long-term negligible impacts of alternative 1, would result in long-term minor adverse impacts on air quality. Under alternative 1, the past, present, and reasonably foreseeable future actions would be the primary contributors to the cumulative impacts. The contribution of the low levels of administrative OSV use under this alternative to overall cumulative impacts would be minimal.

Wheeled vehicle and OSV use outside the boundaries of the park has the potential to impact regional winter season air quality, including the background pollutant levels in the park. Unlike in Yellowstone, the use of BAT snowmobiles (which result in lower CO and HC emissions) is not required on adjacent federal lands. Future trends in the emissions from wheeled vehicles and OSVs operating outside the park will be influenced by the travel management plans of the adjacent national forests. The potential implications of two such travel plans are summarized below—the Gallatin National Forest Travel Plan Revision and the Beartooth District of Custer National Forest Travel Management Plan.

Gallatin National Forest is adjacent to Yellowstone's northern border and part of its western border. The 2006 Record of Decision for the Gallatin National Forest Travel Plan Revision decreased the area of the Gallatin National Forest open to snowmobile use (outside of wilderness areas) from 84% to about 55% (USFS 2006). Snowmobile routes would be concentrated in the areas surrounding West Yellowstone and Cooke City. The FEIS for the Gallatin National Forest Travel Plan Revision concluded that air quality was not a significant issue for the evaluation of the travel plan alternatives and that no violations of the Montana ambient air quality standards or NAAQS would occur (USFS 2006). Therefore, it can be concluded that the impacts of the Gallatin Travel Plan on air quality in Yellowstone would be long-term negligible adverse because it would be less than the effect within Gallatin National Forest itself.

The Beartooth District of Custer National Forest is adjacent to the northeast corner of Yellowstone. A Record of Decision for the Beartooth District Travel Management Plan was issued in 2008 (USFS 2008b). The travel management plan addressed motorized vehicle routes, but OSV regulations were explicitly excluded from the scope of the plan. As a result, OSV use in the Beartooth District remains regulated by a 1986 Forest Plan. OSV use in the small portion of the Beartooth District around Cooke City is administered by the Gallatin National Forest Travel Plan Revision described previously. The 2008 FEIS for the travel management plan concluded that air quality in the Beartooth District would continue to be well under the NAAQS for the following reasons: "(1) good dispersion characteristics across the District, (2) low inversion potential across the District, (3) low emissions from vehicles relative to other potential sources, and 4) reduced or equivalent route miles open to motorized vehicles under all alternatives compared to the existing condition." (USFS 2008b). In addition, the park is generally upwind from the Beartooth District. Therefore, it can be concluded that the impact of the Beartooth District Travel Management Plan on air quality in the park would be long-term negligible adverse because it would be less than the effect within the Beartooth District itself.

Parts of Wyoming and Montana are experiencing record amounts of oil and gas leasing. The pollutant emissions generated by oil and gas drilling include NO_x and SO_2. The emissions from oil and gas drilling can contribute to ozone formation and visibility impacts. Long-term minor adverse impacts to air quality and visibility from oil and gas development in the region can reasonably be expected. Oil and gas development is considered the largest "threat" to air quality in the Greater Yellowstone Area by the Greater Yellowstone Clean Air Partnership (GYC 2005). Specific areas where oil and gas development is concentrated include the Pinedale Anticline and Jonah II natural gas fields near Pinedale, Wyoming (GYC 2005).

The most recent environmental analyses conducted by the Bureau of Land Management (BLM) for oil and gas development in the Pinedale Anticline is provided in the 2008 Pinedale Anticline Project Area Supplemental Environmental Impact Statement (SEIS) (BLM 2008a). BLM approved up to 600 additional well pads and 4,399 wells in the Pinedale Anticline (BLM 2008b). The air quality analyses conducted for the Pinedale Anticline SEIS concluded that there would be no exceedances of the NAAQS or the applicable PSD increments in the analyzed Class I areas, including Yellowstone. This conclusion remained true even in modeling of a cumulative impacts scenario that included other major industrial sources in the region (BLM 2008c).

In terms of visibility impacts, the Pinedale Anticline SEIS analysis predicted a maximum of three days per year where visibility in Yellowstone would change by 0.5 deciview (approximately a 5% change in light extinction) or more taking into account the cumulative emissions of the Pinedale Anticline development, other emissions sources and IMPROVE network background levels. Based on the direct impacts of the Pinedale Anticline development alone, no exceedances of 0.5 deciview were predicted. The analysis is based on 98th percentile values in accordance with Federal Land Managers' Air Quality Related Values Work Group (FLAG) guidance. The BLM analysis results show that the Pinedale Anticline development would not result in adverse visibility impacts in Yellowstone based on the FLAG thresholds for Class I areas (0.5 deciview change for direct impacts and 1.0 deciview change for cumulative impacts).

Another trend with the potential to result in more development is the consolidation of lands in the Gallatin National Forest. In the last ten years, the Gallatin National Forest has negotiated several land exchanges that have consolidated some previously checkerboarded holdings. Although this has generally positive effects for most wildlife (because consolidated lands are less subject to development), it has the negative side-effect of private land consolidation (especially in the Big Sky area), which has allowed more land subdivision and rural growth to occur there, with consequent effects on traffic and air quality (NPS 2007c). Population and employment growth in the Yellowstone region affects winter season air quality through emissions from woodstoves, furnaces, industrial point sources (including power plants and oil refineries), on-road vehicles, and off-road recreational vehicles. The major emissions from woodstoves include PM, CO, VOC and NO_x (USEPA 1995). These same pollutants are also emitted by on-road vehicles and off-road recreational vehicles in the winter. Daily vehicle miles travelled on state highways in Park County and Teton County, Wyoming for 2008 were estimated at 587,627 and 622,770, respectively (WDOT 2008). There is insufficient information available to develop a cumulative emissions scenario taking into account all future emissions from population and employment growth in the region. However, given the existing air quality in the area and increasing emissions standards for both mobile and point sources that will lower pollutant emissions, the impacts of these actions on air quality in the park are considered to be long-term minor adverse.

Conclusion

The effects of alternative 1 on air quality and visibility would be long-term negligible adverse. Cumulative impacts would result in long-term minor adverse impacts on air quality.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Alternative 2 would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.0 ppm, 0.4 ppm, and 0.027 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely, resulting in long-term negligible adverse impacts.

Cumulative Impacts

Impacts on air quality from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term minor adverse impacts of alternative 2, would result in long-term minor adverse cumulative impacts on air quality.

Conclusion

The effect of alternative 2 on air quality would be long-term minor adverse. The effect of alternative 2 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Alternative 3 would result in long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.8 ppm, 0.6 ppm, and 0.027 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely, resulting in long-term negligible adverse impacts.

Cumulative Impacts

Impacts on air quality from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term minor adverse impacts of alternative 3, would result in long-term minor adverse cumulative impacts on air quality.

Conclusion

The effect of alternative 3 on air quality would be long-term minor adverse. The effect of alternative 3 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Alternative 4 would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO and NO_2 concentrations of 0.3 ppm and 0.010 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely, resulting in long-term negligible adverse impacts.

Cumulative Impacts

Impacts on air quality from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term minor adverse impacts of alternative 4, would result in long-term minor adverse cumulative impacts on air quality.

Conclusion

The effect of alternative 4 on air quality would be long-term minor adverse. The effect of alternative 4 on visibility would be long-term minor adverse. Cumulative impacts to air quality and visibility would be long-term, minor adverse.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Alternative 5a would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.2 ppm, 0.5 ppm, and 0.020 ppm, respectively. Air quality would improve with the completion of the transition to BAT snowcoaches. Alternative 5b would have long-term minor adverse impacts to air quality as a result of the predicted maximum 1-hour CO and NO_2 concentrations of 0.3 ppm and 0.019 ppm, respectively. No perceptible visibility impacts would be likely under alternative 5 before, during or after the transition to BAT snowcoaches.

Cumulative Impacts

Impacts on air quality from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term minor adverse impacts of alternative 5, would result in long-term minor adverse cumulative impacts on air quality.

Conclusion

The effects of alternative 5 on air quality would be long-term minor adverse. The effect of alternative 5 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.

Impacts of Alternative 6: Implement Variable Management

Alternative 6 would have long-term minor adverse impacts on air quality as a result of the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.5 ppm, 0.5 ppm, and 0.032 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely. These indicators were based on the highest use day, 540 snowmobiles and 78 snowcoaches; therefore, days when OSV use levels are lower, these impacts would be expected to decrease. One example (from chapter 2) would have 22 days of the winter at the maximum use levels, and 15 days at minimum use levels, with the remaining days at levels in between the minimum and maximum. The example provided in chapter 2 could change from year to year. Also, under this alternative, some areas of the park would have no OSV use for portions of the winter season.

Cumulative Impacts

Impacts on air quality from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term minor adverse impacts of alternative 6, would result in long-term minor adverse cumulative impacts on air quality.

Conclusion

The effect of alternative 6 on air quality would be long-term minor adverse. The effect of alternative 6 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Impacts to air quality under alternative 7 would vary day-to-day based on the level of OSV use allowed. However, the overall air quality impact conclusion for alternative 7 is the same regardless of the level of use—long-term minor adverse impacts. Under alternative 7a, the minor adverse impacts would be due to the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.5 ppm, 0.4 ppm, and 0.032 ppm, respectively. Under alternative 7b, the minor adverse impacts are due to the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 0.7 ppm, 0.3 ppm, and 0.029 ppm, respectively. Under alternative 7c, the minor adverse impacts would be due to the predicted maximum 1-hour CO and NO_2 concentrations of 0.4 ppm and 0.008 ppm, respectively. No exceedance of the NAAQS would occur. No perceptible visibility impacts would be likely.

Cumulative Impacts

Impacts on air quality from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term minor adverse impacts of alternative 7, would result in long-term minor adverse cumulative impacts on air quality.

Conclusion

The effect of alternative 7 on air quality would be long-term minor adverse. The effect of alternative 7 on visibility would be long-term negligible adverse. Cumulative impacts to air quality and visibility would be long-term minor adverse.

SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

GUIDING REGULATIONS AND POLICIES

The NPS Organic Act (16 USC 1) establishes and authorizes the NPS "to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (NPS Organic Act (16 USC 1)). An intact natural soundscape enhances visitor experience and allows for natural functioning of wildlife communication.

Regarding general park soundscape management, NPS *Management Policies 2006*, Section 4.9 "Soundscape Management," requires that the NPS "preserve, to the greatest extent possible, the natural soundscapes of parks." Additionally, the NPS "will restore to the natural condition wherever possible those park soundscapes that have become degraded by the unnatural sounds (noise), and will protect natural soundscapes from unacceptable impacts" (NPS *Management Policies 2006* (NPS 2006a, sec 4.9)). Director's Order 47: Soundscape Preservation and Management, was developed to emphasize NPS policies "that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources." This Director's Order also directs park managers to measure acoustic conditions, differentiate existing or proposed human-made sounds that are consistent with park purposes, set acoustic goals based on the sounds deemed consistent with the park purpose, and determine which noise sources are impacting the parks (NPS 2000d).

SOUNDSCAPES TERMINOLOGY

Refer to "Chapter 3: Affected Environment" for background information on the units used to measure sounds (dBA) and metrics such as percent time audible and L_{eq} (the constant sound level that conveys the same energy as the variable sound levels during the analysis period). Several examples of sound pressure levels in the dBA scale are listed in table 20, including typical sounds found in Yellowstone.

METHODOLOGY

The NPS Natural Sounds Program conducted acoustic modeling to evaluate the potential impacts of the alternatives on natural soundscapes. A brief overview of the modeling methodology and assumptions is provided below. For additional detailed technical information, refer to the soundscapes modeling report (appendix C).

The acoustics modeling conducted by the Volpe National Transportation Systems Center for the 2007 Winter Use Plan FEIS used an adapted version of the Federal Aviation Administration's Integrated Noise Model. For this draft plan/EIS, the NPS adapted the Noise Model Simulation (NMSim) model, primarily used in aviation applications, for analysis of OSVs. NMSim computes the time history of noise as a mobile noise source passes by a receptor location.

Several basic model inputs developed for the 2007 Winter Use Plan FEIS were used for the NMSim analysis, including temperature, relative humidity, snow cover, and natural ambient sound levels. The modeling accounts for the acoustic effects of topography, OSV speeds, and OSV group size. Under the action alternatives, all snowmobiles and snowcoaches were assumed to meet BAT requirements. The maximum number of snowmobiles and snowcoaches allowed under each alternative were allocated to specific link segments throughout the day. The modeling conducted includes the noise generated by administrative vehicles (e.g., road grooming, NPS and concessioner OSVs,). The modeling framework excludes certain factors such as the minor effects of vegetation on sound propagation, inversions, snow cover and the structure of the snow. These modeling limitations are further described in appendix C.

The NMSim outputs were processed with statistical software to generate maps and summary data for the approximately 40,000 grid cells representing the park area. The analysis focused on four key indicators of OSV noise effects:

Percent Time Audible. Percent time audible is a measure of the length of time during an eight-hour day (8:00 a.m. to 4:00 p.m.) that OSV vehicles would be audible to humans with normal hearing in a given grid cell (regardless of the sound level). As discussed in "Chapter 3: Affected Environment," percent time audible constantly varies over time. However, the percent time audible over an 8-hour day provides a useful metric for comparing the alternatives.

Audible Equivalent Sound Level (L_{eq}). Audible L_{eq} measures sound levels experienced in a grid cell during the time that OSVs are audible. L_{eq} is the constant sound level that conveys the same energy as the variable sound levels during the analysis period. Audible L_{eq} differs from the typical calculation of L_{eq} in that it excludes from the analysis period the time during which OSVs are not audible.

Peak 4. Peak 4 is the mean of the four loudest sustained sound levels (at least 15 seconds long) experienced by a grid cell during the day and replaces the maximum sound level (L_{max}) indicator used in previous studies. The modeling interval was 5 seconds, so four values collectively comprise at least 15 seconds of exposure. Peak 4 provides a robust indicator of the loudest events, while avoiding modeling anomalies.

8-hour Equivalent Sound Level (L_{eq}). The 8-hour L_{eq} accounts for the magnitude and duration of OSV sound over the 8:00 a.m. to 4:00 p.m. analysis period (including times when no OSV sounds are audible). This measure differs from percent time audible; L_{eq} provides a measure for magnitude in addition to duration.

Study Area

The study area for assessment of the various alternatives is the park. The study area for the cumulative impacts analysis is the park plus the lands adjacent to the park boundaries.

Analysis Scenarios

Table 49 provides a summary of the alternatives/analysis scenarios modeled for soundscapes impacts. Alternative 1 was modeled based on administrative OSV use only (no visitor OSV use).

Under alternative 5, snowmobile use would be phased out over a five-year period and the number of BAT snowcoaches would be allowed to increase. Two separate analysis conditions were assessed for alternative 5: one representing the start of the transition to BAT snowcoaches (alternative 5a), during which time snowmobiles would be allowed, and one representing all BAT snowcoaches and no snowmobiles (alternative 5b).

Under alternative 6, OSV levels would vary by creating times and places for higher and lower levels of use. Two analysis conditions were assessed for alternative 6. Alternative 6a represents the maximum level of OSV use that would be allowed per day (up to 540 snowmobiles and 78 snowcoaches). Alternative 6b represents the seasonal average daily OSV use level (up to 355 snowmobiles and 51 snowcoaches).

TABLE 49: SOUNDSCAPES ANALYSIS SCENARIOS

Analysis Scenario	Daily Visitor Snowmobile Entries	Daily Visitor Snowcoach Entries	Daily Administrative Snowmobile Trips	Daily Administrative Snowcoach Trips	Daily Commercial Multi-Passenger Wheeled Vehicle Entries
Current Condition[1]	252	28	110	13	0
Alternative 1: No-Action—No Visitor Snowmobile or Snowcoach Use (Administrative Use Only)	0	0			0
Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits	318	78	110	13	0
Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits	720	78	110	13	0
Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles	110	30	110	13	100
Alternative 5a Start: Transition to Snowcoaches meeting BAT Requirements Only	318	78	110	13	0
Alternative 5b Final: Transition to Snowcoaches meeting BAT Requirements Only	0	120	110	13	0
Alternative 6a Maximum: Implement Variable Management	540	78	110	13	0
Alternative 6b Seasonal Average: Implement Variable Management	355	51	110	13	0
Alternative 7a: Provide a Variety of Use Levels and Experiences for Visitors (High)	330	80	110	13	0
Alternative 7b: Provide a Variety of Use Levels and Experiences for Visitors (Medium)	220	50	110	13	0
Alternative 7c: Provide a Variety of Use Levels and Experiences for Visitors (Low)	132	30	110	13	0

[1] Based on the average of the actual OSV entrance volumes from the 2003/2004 winter season through the 2008/2009 winter season.

Alternative 7 proposes a variety of use levels, which would establish a maximum number of snowmobiles and snowcoaches permitted in the park for specific days throughout the winter season. Three different use levels for each vehicle type would be implemented. Snowmobile use would range from 132 to 330 vehicles per day and snowcoach use would range from 30 to 80 vehicles per day. Alternative 7a represents the highest number of OSVs that would be permitted. Alternative 7b provides modeling results for medium OSV use level, and alternative 7c represents the lowest limit on OSV entry to the park.

INTENSITY DEFINITIONS

Separate intensity definitions based on the 8-hour L_{eq} metric are established for travel corridors and backcountry areas (table 50). Although natural quiet is important in both settings, the backcountry intensity definitions are more protective than the intensity definitions for the travel corridor. The intensity definitions are based on accepted noise standards and dose-response studies measuring visitor annoyance with vehicle noise in park settings. For a detailed discussion of the rationale for the soundscapes intensity definitions, refer to appendix C.

TABLE 50: INTENSITY DEFINITIONS FOR SOUNDSCAPES

Impact Level	Travel Corridors	Backcountry
Negligible	8-hour L_{eq} < 15 dBA	8-hour L_{eq} < 5 dBA
Minor	8-hour L_{eq} ≥15 dBA and < 25 dBA	8-hour L_{eq} ≥5 dBA and < 15 dBA
Moderate	8-hour L_{eq} ≥ 25 dBA and 8-hour L_{eq} < 35 dBA or 8-hour L_{eq} ≤ 35 dBA in 90% of the travel corridor area	8-hour L_{eq} ≥ 15 dBA and 8-hour L_{eq} < 25 dBA or 8-hour L_{eq} ≤ 25 dBA in 90% of the backcountry area
Major	8-hour L_{eq} ≥ 35 dBA for greater than 10 percent of the total travel corridor area	8-hour L_{eq} ≥ 25 dBA for greater than 10 percent of the total backcountry area

SUMMARY OF MODELING RESULTS

This section provides an overview of the soundscapes analysis results, including summary comparison tables for the action alternatives. Alternative-specific impact descriptions are provided in subsequent sections and include discussion of cumulative effects and the conclusions for each alternative. For all of the following tables (showing modeling results), the current condition column represents use levels under the 2009 interim rule that was in effect for the 2009/2010 and 2010/2011 winter seasons.

Percent Time Audible

Percent time audible is a measure of the length of time during an eight-hour day (8:00 a.m. to 4:00 p.m.) that OSV vehicles would be audible to humans with normal hearing (regardless of the sound level). For example, 50 percent time audible means OSV sounds could potentially be heard in specified areas for 50 percent of the day, or four hours during an eight-hour day – not necessarily consecutive hours, but spaced throughout the day. Tables 51 and 52 summarize the percent time audible results for the travel corridor and backcountry areas, respectively. Mapping of the percent time audible results for each alternative is provided in appendix C.

TABLE 51: TRAVEL CORRIDOR PERCENT TIME AUDIBLE MODELING RESULTS

Percent Time Audible	Percent of Travel Corridor Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Alt. 7a	Alt. 7b	Alt. 7c
0	8.4	9.0	8.4	8.4	8.2	8.4	8.7	8.4	8.4	8.4	8.5	8.5
1 to 20	23.5	40.2	17.2	14.2	21.9	17.4	15.0	15.2	18.9	18.0	23.1	28.9
21 to 50	36.3	41.7	29.6	26.3	25.3	30.0	29.3	28.0	32.9	30.7	36.7	39.7
51 to 80	26.2	8.6	29.6	30.2	30.9	30.1	30.1	30.3	29.3	30.4	24.0	19.7
Over 80	5.6	0.5	15.2	20.9	13.7	14.1	16.9	18.1	10.5	12.5	7.7	3.2

Notes: Percent time audible calculated for the 8-hour period from 8:00 a.m. to 4:00 p.m.

TABLE 52: BACKCOUNTRY PERCENT TIME AUDIBLE MODELING RESULTS

Percent Time Audible	Percent of Backcountry Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Alt. 7a	Alt. 7b	Alt. 7c
0	89.2	89.7	89.1	89.1	89.2	89.1	89.3	89.1	89.2	89.1	89.2	89.3
1 to 20	6.7	8.2	5.7	5.4	6.3	5.8	5.3	5.5	6.0	5.9	6.8	7.3
21 to 50	2.9	2.0	3.1	3.0	2.7	3.1	3.2	3.1	3.1	3.2	2.8	2.7
51 to 80	1.1	0.1	1.6	1.6	1.5	1.6	1.5	1.6	1.4	1.4	1.0	0.7
Over 80	0.1	0.0	0.5	0.9	0.3	0.4	0.7	0.7	0.3	0.4	0.2	0.0

Notes: Percent time audible calculated for the 8-hour period from 8:00 a.m. to 4:00 p.m.

Under use levels that occurred during the interim rule, OSV sounds are audible to a human with normal hearing between 51% and 80% of the time in 26.2% of the travel corridor area (table 51). In 5.6% of the travel corridor area, OSV sounds are audible over 80% of the time. The areas with longest percent time audible are on and adjacent to roadways. Alternative 1 would reduce the area of the travel corridor OSVs audible over 80 percent of the time to 0.5%. The OSV use levels modeled under all the action alternatives would increase the area of the travel corridor where OSV sounds are audible over 80% of the time, relative to alternative 1. The largest increase in OSV time audible would be under alternative 3 (the alternative with the highest OSV use levels). Alternative 7c is the action alternative with the smallest increase in OSV audibility relative to the no-action alternative and would reduce OSV audibility compared to the current condition.

As shown in table 52, OSVs are not audible in approximately 89-90% of the backcountry area under the current conditions and any of the alternatives. As would be expected, the primary influence of the alternatives on OSV audibility is within the travel corridors. However, some changes in the area of the backcountry with OSVs audible more than 80% of the time do occur. For example, the area of the backcountry with OSVs audible more than 80% of the time would increase from 0% under alternative 1 to 0.9% under alternative 3. The areas of the backcountry where the audibility of OSVs would increase are generally adjacent to the boundary between the travel corridor and backcountry management zones.

Audible L_{eq}

Whereas percent time audible describes whether or not OSVs are audible, audible L_{eq} describes how high the sound levels are during those times that OSVs are audible. Audible L_{eq} is expressed as an equivalent sound level—the constant sound level conveying the same energy as all the varying sound levels over the 8:00 a.m. to 4:00 p.m. analysis period (excluding those times when OSVs are not audible). Tables 53 and 54 summarize the audible L_{eq} results for the travel corridor and backcountry areas, respectively. Mapping of the audible L_{eq} results for each alternative is provided in appendix C.

TABLE 53: TRAVEL CORRIDOR AUDIBLE L_{EQ} MODELING RESULTS

Audible L_{eq} (dBA)	Percent of Travel Corridor Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Al. 7a	Al. 7b	Al. 7c
0 or less	8.5	9.0	8.5	8.5	8.3	8.5	8.9	8.5	8.5	8.5	8.5	8.6
1 to 20	42.6	55.0	40.1	34.5	44.5	40.0	48.8	36.2	39.0	40.5	42.9	44.4
21 to 35	38.4	29.3	39.2	41.4	36.6	39.3	34.6	40.8	39.6	38.9	37.6	37.7
36 to 60	10.3	6.6	11.9	15.1	10.3	11.9	7.6	14.1	12.6	11.9	10.8	9.1
Over 60	0.2	0.1	0.3	0.5	0.3	0.3	0.1	0.4	0.3	0.2	0.2	0.2

TABLE 54: BACKCOUNTRY AUDIBLE L_{EQ} MODELING RESULTS

Audible L_{eq}	Percent of Backcountry Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Alt. 7a	Alt. 7b	Alt. 7c
0 or less	89.2	89.7	89.2	89.2	89.3	89.2	89.7	89.2	89.2	89.2	89.2	89.3
1 to 10	10.5	10.3	10.5	10.2	10.5	10.5	10.2	10.3	10.5	10.5	10.6	10.5
11 to 20	0.3	0.0	0.3	0.6	0.2	0.3	0.1	0.5	0.3	0.3	0.2	0.2
Over 20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Under use levels that occurred under the 2009 interim rule, audible L_{eq} is between 1 and 35 dBA in approximately 81% of the travel corridor. American National Standards Institute (ANSI) standard 2.12 specifies 35 dBA as the desired background condition for many indoor spaces where quiet and outstanding listening conditions are important (bedrooms, auditoria, theaters, conference rooms). Only 10.3% of the travel corridor area has an audible L_{eq} between 36 and 60 dBA, and 0.2% exceeds 60 dBA. Sound levels of 50 to 60 dBA are common in environments with human conversations, such as an office. Under alternative 1, 6.7% of the travel corridor would have an audible L_{eq} over 35 dBA and 0.1% exceeds 60 dBA. The OSV use levels modeled under all of the action alternatives would increase the percentage of the travel corridor with an audible L_{eq} over 35 dBA compared to the no-action alternative. Alternatives 4, 5b, and 7c (the conditions with the lowest OSV use levels modeled) would reduce the area of the travel corridor with an audible L_{eq} over 35 dBA relative to the current condition.

Table 54 shows that OSV audible L_{eq} sound levels in nearly 90 percent of the backcountry area are very low under current conditions, the no-action alternative, and any of the action alternatives. Small differences in backcountry audible L_{eq} are shown in the range of 11 to 20 dBA. Under any of the alternatives, backcountry audible L_{eq} would not exceed 20 dBA.

Peak 4

Percent time audible and audible L_{eq} do not provide information on short-duration peaks in OSV sound levels that can be important to understanding impacts on natural soundscapes. Peak 4 is the mean of the four loudest sustained sound levels (at least 15 seconds in duration) during the 8:00 a.m. to 4:00 p.m. analysis period. The peak 4 results are influenced mainly by the loudest vehicle in use, rather than the total traffic. Tables 55 and 56 summarize the peak 4 results for the travel corridor and backcountry areas, respectively. Mapping of the peak 4 results for each alternative is provided in appendix C.

TABLE 55: TRAVEL CORRIDOR PEAK 4 MODELING RESULTS

Peak 4 (dBA)	Percent of Travel Corridor Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Alt. 7a	Alt. 7b	Alt. 7c
0 or less	5.3	9.4	5.3	5.3	6.8	5.3	9.4	5.3	5.3	5.3	5.3	5.8
1 to 20	19.7	31.6	19.7	19.7	22.7	19.7	31.6	19.7	19.7	19.7	19.7	21.0
21 to 35	36.5	40.8	36.5	36.5	39.4	36.5	40.8	36.5	36.5	36.5	36.5	37.6
36 to 60	35.2	16.9	35.2	35.2	28.3	35.2	16.9	35.2	35.2	35.2	35.2	32.7
61 to 80	3.2	1.3	3.2	3.2	2.8	3.2	1.3	3.2	3.2	3.2	3.2	2.9
Over 80	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.0

TABLE 56: BACKCOUNTRY PEAK 4 MODELING RESULTS

Peak 4 (dBA)	Percent of Backcountry Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Alt. 7a	Alt. 7b	Alt. 7c
0 or less	83.4	90.2	83.4	83.4	86.3	83.4	90.2	83.4	83.4	83.4	83.4	84.3
1 to 10	8.4	6.4	8.4	8.4	7.3	8.4	6.4	8.4	8.4	8.4	8.4	8.2
11 to 20	5.6	3.2	5.6	5.6	4.7	5.6	3.2	5.6	5.6	5.6	5.6	5.3
21 to 30	2.4	0.2	2.4	2.4	1.6	2.4	0.2	2.4	2.4	2.4	2.4	2.0
31 to 35	0.2	0.0	0.2	0.2	0.1	0.2	0.0	0.2	0.2	0.2	0.2	0.2
Over 35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Under use levels that occurred during the 2009 interim rule, 61.5% of the travel corridor area experiences peak 4 levels of 35 dBA or less (table 55). In 35.2% of the travel corridor, peak 4 sound levels are between 36 and 60 dBA and in 3.2% of the travel corridor peak 4 sound levels are between 61 and 80 dBA. Only 0.1% of the travel corridor experiences peak 4 sound levels over 80 dBA under the current conditions. A sound level of 80 dBA is roughly equivalent to average city traffic (see table 20 in chapter 3). Alternatives 2, 3, 5a, 6a, and 6b would not substantially change the area of the travel corridor in each of the peak 4 categories. The area of the travel corridor in the higher peak 4 categories (over 60 dBA) would be reduced under alternatives 4 and 5b relative to the current conditions. Both of these alternatives would eliminate peak 4 levels over 80 dBA.

Under alternative 1, 81.8% of the travel corridor area experiences peak 4 levels of 35 dBA or less. In 16.9% of the travel corridor, peak 4 sound levels are between 36 and 60 dBA and in 1.3% of the travel corridor peak 4 sound levels are between 61 and 80 dBA. Under alternative 1, peak 4 sound levels would not exceed 80 dBA.

All the action alternatives (except for alternative 5b) increase the area of the travel corridor with peak 4 sound levels over 60 dBA compared to alternative 1. Alternatives 4, 5b, and 7c reduce the area of the travel corridor with peak 4 sound levels over 60 dBA compared to the current condition and eliminate peak 4 sound levels over 80 dBA.

Table 56 shows that even peak sound levels in the backcountry are relatively quiet. Peak 4 sound levels in the backcountry do not exceed 35 dBA under the current condition, the no-action alternative, or any of the action alternatives. All of the action alternatives (except for alternative 5b) would increase the area of the backcountry with peak 4 sound levels over 30 dBA compared to alternative 1. Alternatives 4 and 5b would reduce the area of the backcountry with peak 4 sound levels over 30 dBA compared to the current condition.

8-Hour L_{eq}

The 8-hour L_{eq} analysis results for the travel corridor and backcountry areas are provided in tables 57 and 58, respectively. The 8-hour L_{eq} results are presented graphically in appendix C.

TABLE 57: TRAVEL CORRIDOR 8-HOUR L_{EQ} MODELING RESULTS

8-hour L_{eq} (dBA)	Percent of Travel Corridor Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Alt. 7a	Alt. 7b	Alt. 7c
< 15 (Negligible)	48.7	65.5	43.7	38.7	48.4	43.8	51.1	40.3	44.0	45.1	48.9	52.3
≥ 15 and < 25 (Minor)	27.4	23.1	27.3	26.1	26.9	27.4	27.1	26.5	27.3	26.8	26.3	26.8
≥ 25 and < 35 (Moderate)	16.9	7.8	20.1	22.9	16.8	20.0	16.0	22.1	19.8	19.3	17.4	14.8
≥ 35 (Major)*	7.0	3.6	8.9	12.2	7.8	8.9	5.9	11.0	8.9	8.9	7.4	6.0

*Overall impacts of an alternative were considered to be moderate if less than 10 percent of the travel corridor area had an 8-hour L_{eq} ≥ 35 dBA, see table 50 for the intensity definitions.

TABLE 58: BACKCOUNTRY 8-HOUR L_{EQ} MODELING RESULTS

8-hour L_{eq} (dBA)	Percent of Backcountry Area											
	Current Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5a	Alt. 5b	Alt. 6a	Alt. 6b	Alt. 7a	Alt. 7b	Alt. 7c
< 5 (Negligible)	97.1	99.1	96.3	95.5	97.3	96.4	97.5	95.8	96.4	96.5	97.1	97.6
≥ 5 and < 15 (Minor)	2.4	0.9	3.0	3.4	2.3	3.0	2.2	3.2	3.0	2.8	2.4	2.1
≥ 15 and < 25 (Moderate)	0.5	0.0	0.7	1.1	0.4	0.7	0.3	0.9	0.7	0.7	0.5	0.3
≥ 25 (Major)*	0.0	0.0	0.0	0.1	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*Overall impacts of an alternative were considered to be moderate if less than 10 percent of the backcountry area had an 8-hour L_{eq} ≥ 25 dBA, see table 50 for the intensity definitions.

Within the travel corridors, the highest 8-hour L_{eq} levels (≥ 35 dBA) occur on and adjacent to roadways. Under current conditions, approximately 7% of the travel corridor area experiences 8-hour L_{eq} sound levels greater than or equal to 35 dBA (table 57). Under alternative 1, the area of the travel corridor with 8-hour L_{eq} sound levels greater than or equal to 35 dBA would be reduced to 3.6%. Sound levels decrease with increasing distance from roadways and are generally less than 15 dBA near the edges of the boundary between the travel corridor and the backcountry. All the action alternatives increase the area of travel corridor with 8-hour L_{eq} sound levels greater than or equal to 35 dBA compared to the no-action alternative. The alternatives with the largest impact are alternative 3 (12.2% ≥ 35 dBA) and alternative 6a (11.0% ≥ 35 dBA).

Under alternative 1, all of the backcountry area would have 8-hour L_{eq} sound levels less than 15 dBA. All the action alternatives would increase 8-hour sound levels in the 15 to 25 dBA range in 1.1% or less of the backcountry. The 8-hour L_{eq} sound level in the backcountry would not exceed 25 dBA, except under alternative 3, where 0.1% of the backcountry would be at or exceeding 25 dBA. Under all alternatives, 96% or more of the backcountry area would have an 8-hour L_{eq} of less than 5 dBA.

SUMMARY OF IMPACTS

This section summarizes the impact analysis results for each alternative, discusses cumulative effects and draws conclusions regarding the effect of each alternative on soundscapes. A detailed discussion of each alternative follows.

- Alternative 1 would have long-term moderate adverse impacts on soundscapes in travel corridors and long-term minor adverse impacts in backcountry areas.
- Alternative 2 would have long-term moderate adverse impacts on soundscapes in both the travel corridor and backcountry areas.
- Alternative 3 would have long-term major adverse impacts on soundscapes in travel corridors and long-term moderate adverse impacts in backcountry areas. Therefore, alternative 3 would result in greater impacts on natural soundscapes than the current conditions (use levels under the 2009 interim rule).
- Alternative 4 would have long-term moderate adverse impacts on soundscapes in both the travel corridor and backcountry areas.
- Alternative 5a would result in greater impacts on natural soundscapes than the current condition. Although OSVs would be audible over a larger area than the current condition under alternative 5b, the overall impact of alternative 5b on soundscapes would be less than the current condition based on consideration of other metrics (e.g., 8-hour L_{eq}, audible L_{eq}, peak 4).
- Alternative 6a (maximum OSV use level) would have long-term major adverse impacts on soundscapes in travel corridors and long-term moderate adverse impacts in backcountry areas. Alternative 6b (seasonal average OSV use level) would result in long-term moderate adverse impacts in the travel corridors and backcountry areas.
- Alternatives 7a, 7b, and 7c would all have long-term moderate adverse impacts on soundscapes in the travel corridors and backcountry areas. The impact conclusion is the same, the soundscapes impact under these alternatives would vary, and the greatest impact occurring under alternative 7a (highest OSV use) and smallest impact occurring under alternative 7c (lowest OSV use).

DETAILED IMPACT ANALYSIS

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Under alternative 1, within the travel corridors, 3.6% of the area would have an 8-hour L_{eq} greater than or equal to 35 dBA (compared to 7% in the current condition). In the backcountry, 0% of the area would have an 8-hour L_{eq} greater than or equal to 15 dBA (compared to 0.5% in the current condition). Administrative OSVs would be audible over 50% of the time in approximately 9.1% of the travel corridor area, compared to 31.8% of the travel corridor area under current conditions. Alternative 1 would have long-term moderate adverse impacts on soundscapes in travel corridors and long-term minor adverse impacts backcountry areas.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions both outside and within the park have the potential to impact soundscapes in the park. Aircraft overflights (including commercial jets, research flights in low-flying propeller planes, corporate and general aviation aircraft, and medical rescue helicopters) cause motorized sounds that are audible at sound levels which range from very quiet to levels that mask other sounds. Relative to snowmobile- and snowcoach-related sounds, the duration of audible aircraft overflights is short. The 2005-2010 observational study found that in total, motorized sounds were audible 56% of the time. Aircraft accounted for 6.7% of the duration of motorized sounds (Burson 2010a). As shown in table 59, jets are responsible for the majority of the duration of audible aircraft sounds.

TABLE 59: AIRCRAFT TIME AUDIBLE, 2005-2010 OBSERVATIONAL STUDY

	Time Audible (Hours: Minutes: Seconds)	Percent out of the Total Duration of Motorized Sounds	Percent out of the Total Duration of the Observational Study
Jets	6:30:41	4.5%	2.5%
Propeller aircraft	2:39:10	1.8%	1.0%
Helicopters	0:32:43	0.4%	0.2%
Total	9:42:34	6.7%	3.8%

The observational study results reported above are based on monitoring in developed and travel corridor locations. Aircraft overflights are audible approximately 6% of the average day in backcountry areas such as Fern Lake (Burson 2007). Taking into account both natural and non-natural sounds, hourly L_{eq} sound levels were generally between 20 and 30 dBA at Fern Lake and maximum hourly sound levels were 60 dBA. No OSV sounds were audible at Fern Lake, which is 8 miles from the nearest OSV corridor (the road between Fishing Bridge and Canyon). In the winter, aircraft are about the only source of non-natural sounds in backcountry areas far from roadways.

Despite recent slowing in the growth in air travel mirroring the recession-related slow down in overall economic activity, long-term growth is still expected according to Federal Aviation Administration forecasts (FAA 2010). As a result, aircraft overflights are expected to continue to result in short and long-term minor adverse impacts, particularly in backcountry areas and on days with low wind levels.

Due to the attenuation of sound with increasing distance from the source, OSV use outside the park boundaries is unlikely to affect substantial portions of the interior of the park. However, in some areas within a few miles of the park boundary, OSV use outside the park is a major source of non-natural sounds. For example, snowmobiles operating outside Yellowstone's western boundary in Gallatin National Forest and possibly in West Yellowstone, Montana were commonly audible at the West Yellowstone 3.1 site (three miles from the park boundary) during 2004/2005 monitoring (Burson 2005). The distinctive sounds of two-stroke snowmobiles over three miles away were clearly distinguishable in recordings and while visiting the site. The percent time audible at West Yellowstone of OSVs traveling only on the groomed road between the west entrance and Madison Junction was estimated to be 36%. However, OSV use outside the park raised the total percent time audible at West Yellowstone 3.1 to 66% (Burson 2005).

There is insufficient monitoring information available to quantify the audibility of OSVs outside the park in locations other than West Yellowstone 3.1. The audibility of OSVs outside the park has not been specifically noted at any monitoring site other than West Yellowstone 3.1 (Burson 2004-2010). One trend with the potential to result in more OSV activity outside the park is the consolidation of lands in the Gallatin National Forest. In the last 10 years, the Gallatin National Forest has negotiated several land exchanges that have consolidated some previously checkerboarded holdings. Although this has generally positive effects for most wildlife (because consolidated lands are less subject to development), it has the negative side-effect of private land consolidation (especially in the Big Sky area), which has allowed more land subdivision and rural growth to occur there, with consequent effects on traffic and natural soundscapes (NPS 2007c).

Future trends in the audibility of OSVs operating outside the park will be influenced by the travel management plans of the adjacent national forests. The potential implications of two such travel plans are summarized below—the Gallatin National Forest Travel Plan Revision and the Beartooth District of Custer National Forest Travel Management Plan.

Gallatin National Forest is adjacent to Yellowstone's northern border and part of its western border. The 2006 Record of Decision for the Gallatin National Forest Travel Plan Revision decreased the area of the Gallatin National Forest open to snowmobile use (outside of wilderness areas) from 84% to about 55% (USFS 2006). The travel plan was designed to cluster motorized use areas to reduce the total area potentially affected by noise from snowmobiles. As a result, the USFS expected noise levels would increase in those concentrated use zones and decrease elsewhere. The largest concentration of designated snowmobile trails in the Gallatin National Forest in the vicinity of the park is around West Yellowstone. There is a smaller number and length of snowmobile trails around Cooke City. Snowmobile use is prohibited in most of the remaining areas along the border between Gallatin National Forest and Yellowstone National Park (e.g., the Lee Metcalf Wilderness Area to the west and the Absaroka Beartooth Wilderness to the north). It can be reasonably expected that the audibility of OSVs in use outside the park will increase in the future within a few miles of the trails around West Yellowstone and Cooke City. Other areas of Yellowstone adjacent to wilderness areas would not be affected by OSV use.

The Beartooth District of Custer National Forest is adjacent to the northeast corner of Yellowstone. A Record of Decision for the Beartooth District Travel Management Plan was issued in 2008 (USFS 2008b). The travel management plan addressed motorized vehicle routes, but OSV regulations were explicitly excluded from the scope of the plan. As a result, OSV use in the Beartooth District remains regulated by a 1986 Forest Plan. OSV use in the small portion of the Beartooth District around Cooke City is administered by the Gallatin National Forest Travel Plan Revision described previously. The motorized routes allowed by the 2008 Travel Management Plan are all at least 15 miles from the boundary of Yellowstone. As a result, it can be concluded that motorized vehicle routes in the Beartooth District would have no effect on natural soundscapes in Yellowstone. Motorized vehicle use (including OSVs) is prohibited in the Absaroka Beartooth Wilderness Area, which covers much of the Beartooth District where it is adjacent to the park.

The impacts of past, present, and reasonably foreseeable future actions, combined with the long-term negligible impacts of alternative 1, would result in long-term minor adverse cumulative impacts on natural soundscapes. Under alternative 1, other past, present, and reasonably foreseeable future actions (e.g., airplanes, OSV use outside the park) would be the primary contributors to the cumulative impacts. The contribution of the low levels of administrative OSV use under this alternative to overall cumulative impacts in both the travel corridors and backcountry would be minimal.

Conclusion

The effects of alternative 1 on soundscapes would be long-term, minor to moderate, and adverse due to administrative OSV use. Moderate impacts would be limited to travel corridors. Cumulative impacts to soundscapes would be long-term, minor and adverse.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Under alternative 2, within the travel corridors, 8.9% of the area would have an 8-hour L_{eq} greater than or equal to 35 dBA (compared to 7% under current conditions). In the backcountry, 0.7% of the area would have an 8-hour L_{eq} greater than or equal to 15 dBA (compared to 0.5% in the current condition). Assuming the maximum allowed use levels, OSVs would be audible over 50% of the time in approximately 44.8% of the travel corridor area, compared to 31.8% of the travel corridor area under current conditions. Alternative 2 would have long-term moderate adverse impacts on soundscapes in both the travel corridor and backcountry areas.

Cumulative Impacts

Impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor adverse effects of these actions, when combined with the long-term moderate adverse impacts of alternative 2, would result in long-term moderate adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative 2 on soundscapes would be long-term, moderate and adverse due to the level of OSV use permitted. Cumulative impacts to soundscapes would be long-term, moderate and adverse.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Under alternative 3, within the travel corridors, 12.2% of the area would have an 8-hour L_{eq} greater than or equal to 35 dBA (compared to 7% under current conditions). In the backcountry, 1.2% of the area would have an 8-hour L_{eq} greater than or equal to 15 dBA (compared to 0.5% under current conditions). Assuming the maximum allowed use levels, OSVs would be audible over 50% of the time in approximately 51.1% of the travel corridor area, compared to 31.8% of the travel corridor area under current conditions. Alternative 3 would have long-term major adverse impacts on soundscapes in the travel corridor areas and long-term moderate adverse impacts in the backcountry areas. As a result, alternative 3 would result in greater impacts on natural soundscapes than the current conditions.

Cumulative Impacts

Impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor adverse effects of these actions, when combined with the long-term moderate to major adverse impacts of alternative 3, would result in long-term moderate to major adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative 3 on soundscapes would be long-term, moderate to major and adverse. Major impacts would be limited to the travel corridor, due to the increased level of OSV use. Cumulative impacts to soundscapes would be long-term, moderate to major and adverse.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Under alternative 4, within the travel corridors 7.8% of the area would have an 8-hour L_{eq} greater than or equal to 35 dBA (compared to 7% under current conditions). In the backcountry, 0.4% of the area would have an 8-hour L_{eq} greater than or equal to 15 dBA (compared to 0.4% in the current condition). Assuming the maximum allowed use levels, OSVs and/or wheeled vehicles would be audible more than 50% of the time in approximately 44.6% of the travel corridor area, compared to 31.8% of the travel corridor area under current conditions. Alternative 4 would have long-term moderate adverse impacts on soundscapes in both the travel corridor and backcountry areas.

Cumulative Impacts

Impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor adverse impacts of these actions, when combined with the long-term moderate adverse impacts of alternative 4, would result in long-term moderate adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative 4 on soundscapes would be long-term, moderate and adverse, due to the permitted level of OSV use. Cumulative impacts to soundscapes would be long-term, moderate and adverse.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Alternative 5 would have long-term moderate adverse impacts on soundscapes in both the travel corridor and backcountry areas. This moderate impact conclusion is the same for alternative 5a (start of the transition to BAT snowcoaches) and alternative 5b (completion of the transition to BAT snowcoaches only). When compared to each other, alternative 5b shows slightly lower impacts on soundscapes than alternative 5a. Within the travel corridors, 8.9% and 5.9% of the area would have an 8-hour L_{eq} greater than or equal to 35 dBA under alternative 5a and alternative 5b, respectively (compared to 7% under current conditions). In the backcountry, 0.7% and 0.3% of the area would have an 8-hour L_{eq} greater than or equal to 15 dBA under alternative 5a and 5b, respectively (compared to 0.5% under current conditions). Assuming the maximum allowed use levels, OSVs would be audible over 50% of the time in approximately 44.2% of the travel corridor area under alternative 5a, compared to 31.8% of the travel corridor area under current conditions. Under alternative 5b, OSVs would be audible in 47% the travel corridor area over 50% of the time. Overall, impacts under alternative 5 (before and after the phase out to snowcoaches only) would be long-term, moderate, adverse. Alternative 5a would result in greater impacts on natural soundscapes than the current condition. Although OSVs would be audible over a larger area than the current condition under alternative 5b, the overall impact of alternative 5b on soundscapes would be less than the current condition based on consideration of other metrics (e.g., 8-hour L_{eq}, audible L_{eq}, peak 4).

Cumulative Impacts

Impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor adverse impacts of these actions, when combined with the long-term moderate adverse impacts of alternative 5, would result in long-term moderate adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative 5 on soundscapes would be long-term, moderate and adverse, both before and after the phase out to snowmobiles only. Cumulative impacts to soundscapes would be long-term, moderate and adverse.

Alternative 6: Implement Variable Management

Alternative 6a (maximum OSV use level) would have long-term major adverse impacts on soundscapes in the travel corridors and long-term moderate adverse impacts in backcountry areas. Alternative 6b (seasonal average OSV use level) would result in long-term moderate adverse impacts in both the travel corridors and backcountry areas. There are many different scenarios; one example (from chapter 2) would have 22 days of the winter at the maximum use levels, and 15 days at minimum use levels, with the remaining days at levels in between the minimum and maximum. The example provided in chapter 2 could change from year to year. Also, under this alternative, some areas of the park would have no OSV use for parts of the winter season.

Within the travel corridors, 11% and 8.9% of the area would have an 8-hour L_{eq} greater than or equal to 35 dBA under alternative 6a and alternative 6b, respectively (compared to 7% under current conditions). In the backcountry, 0.7% and 0.3% of the area would have an 8-hour L_{eq} greater than or equal to 15 dBA under alternative 6a and alternative 6b, respectively (compared to 0.5% in the current condition) OSVs would be audible over 50% of the time in approximately 48.4% of the travel corridor area under alternative 6a, compared to 31.8% of the travel corridor area under current conditions and 39.8% under alternative 6b.

Cumulative Impacts

Impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor adverse impacts of these actions, when combined with the long-term moderate to major adverse impacts of alternative 6, would result in long-term moderate to major adverse cumulative impacts on natural soundscapes.

Conclusion

The effects of alternative 6 on soundscapes would be long-term, moderate to major, adverse representing the range between low and high use days under alternative 6. Cumulative impacts to soundscapes would be long-term, moderate to major and adverse.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Alternatives 7a, 7b, and 7c would all have long-term moderate adverse impacts on soundscapes in the travel corridors and backcountry areas. Although the impact conclusion is the same, the soundscapes impact under these alternatives would vary, with the greatest impact occurring under alternative 7a (highest OSV use) and smallest impact occurring under alternative 7c (lowest OSV use).

Under alternative 7a, within the travel corridors, 8.9% of the area would have an 8-hour L_{eq} greater than or equal to 35 dBA (compared to 7% in the current condition). Under alternatives 7b and 7c, the area of the travel corridor with an 8-hour L_{eq} greater than or equal to 35 dBA would be 7.4% and 6.0%, respectively.

In the backcountry, 0.7% of the area would have an 8-hour L_{eq} greater than or equal to 15 dBA under alternative 7a (compared to 0.5% in the current condition). Under alternatives 7b and 7c, the area of the backcountry with an 8-hour L_{eq} greater than or equal to 15 dBA would be 0.7% and -0.5%, respectively.

Assuming the maximum allowed use levels, OSVs would be audible over 50% of the time in approximately 42.9% of the travel corridor area under alternative 7a, compared to 31.8% of the travel corridor area under current conditions. Under alternatives 7b and 7c, the area of the travel corridor with OSVs audible over 50% of the time would be 31.7% and 22.9%, respectively.

Cumulative Impacts

Impacts on soundscapes from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The long-term minor adverse impacts of these actions, when combined with the long-term moderate adverse impacts of alternative 7, would result in long-term moderate adverse cumulative impacts on natural soundscapes.

Conclusion

The effect of alternative 7 on soundscapes would be long-term, moderate adverse. Cumulative impacts to soundscapes would be long-term, moderate and adverse.

VISITOR USE AND EXPERIENCE

Current laws and NPS policies indicate the following desired conditions in the park with regard to visitor use and experience relative to the presence and operation of OSVs in the park. Under the Organic Act, General Authorities Act, and NPS *Management Policies 2006*, opportunities are and should continue to be provided for appropriate, high-quality public enjoyment. Visitors will have the opportunity to enjoy the superlative natural resources found in the park. Such opportunities will create ample opportunity for inspiration, appreciation, and enjoyment through personalized experiences.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY DEFINITIONS

This section includes an analysis of the opportunities to view and experience park resources in the winter. Such opportunities are different than those experienced in the summer. Resources considered in the analysis include opportunities to view wildlife and scenery, behavior of other visitors with regards to safety, quality of road surfaces, availability of information, quiet and solitude, air quality, and stakeholder values.

To evaluate the level of impact to the visitor experience under each alternative, the following types of information were referenced:

- Visitor surveys
- Assessment of visitation patterns
- Assessment of opportunities historically available.

The following definitions for evaluating impacts to visitor use and experience were used for assessing the potential impacts of each alternative.

Negligible: Visitors would be able to experience a wide range of park resources and participate in a wide range of winter use activities, although may be prevented from a few experiences and/or activities because of limited access, technical difficulty, and/or cost. Visitors would typically be able to fulfill the purpose of their visit.

Minor: Visitors would be able to experience a range of park resources and participate in a range of winter use activities, but would be prevented from some experiences and/or activities because of limited access, technical difficulty, and/or cost. Most visitors would be able to fulfill the purpose of their visit.

Moderate: Visitors would be able to experience some park resources and participate in some winter use activities, but would be prevented from some experiences and/or activities because of limited access, technical difficulty, and/or cost. Some visitors may not be able to fulfill the purpose of their visit.

Major: Visitors would be able to experience some park resources and participate in some winter use activities, but would be prevented from most experiences and/or activities because of limited access, technical difficulty, and/or cost. Few visitors would be able to fulfill the purpose of their visit.

Study Area

The geographic study area for the visitor use and experience analysis includes the entire area within the park boundary.

SUMMARY OF IMPACTS

Impacts to visitor use and experience under the alternatives ranged from long-term major adverse under the no-action alternative, to long-term beneficial under the action alternatives because the levels and types of OSV use permitted in the park would be increased, when compared to the no-action alternative. Impacts under each alternative were as follows:

- Alternative 1 would have long-term major adverse impacts on visitor use and experience because winter access to the interior of the park would not be provided for visitors. Non-motorized visitors would be permitted, but due to the distance into the park and harsh weather conditions, very few visitors would be able to reach features in the interior such as Old Faithful. Winter visitors desiring either or both non-motorized and motorized experiences would be affected by this loss of access.

- Alternative 2 would have long-term beneficial impacts to visitor use and experience because permitted use levels would be similar to those under 2009 interim rule conditions (2009/2010 winter season) and would provide for both motorized and non-motorized (accessing trail heads by motorized means) access into the interior of the park. This use level would meet the level of demand for winter visitation that has occurred for the 2009/2010 winter season and it would provide limited opportunities for growth. Resource conditions (i.e., wildlife, soundscapes, and air quality) that support a quality visitor experience would experience limited effects.
- Alternative 3 would have long-term beneficial impacts to visitor use and experience in terms of access and long-term minor adverse impacts occurring from any decrease in visitor satisfaction. The opportunity for OSV access to the interior of the park would increase due to higher use limits, but the higher number of OSVs in the park may affect resource conditions (i.e., wildlife and soundscapes) to a greater extent than in recent years and may affect the ability to view wildlife and experience natural sounds. Also, some non-motorized users may be adversely impacted by an increase in OSV use.
- Alternative 4 would have long-term beneficial impacts to visitor use and experience, because motorized access to the interior of the park would continue and would be expanded to include commercial wheeled vehicles. However, because the number of snowmobiles and snowcoaches permitted would decrease from 2009 interim rule (2009/2010 winter season) levels, the demand for OSV use may not be met and those visitors that cannot obtain their desired experience would have long-term moderate adverse impacts for this user group.
- Alternative 5 would have long-term beneficial impacts to visitor use and experience because motorized access to the interior of the park would continue and until the transition to snowcoaches only, would be the same as 2009 interim rule (2009/2010 winter season) use limits. After the transition, those desiring snowcoach access would still experience long-term beneficial impacts, whereas those desiring snowmobile access would experience long-term moderate adverse impacts, because this experience may not be available.
- Alternative 6 would have long-term beneficial impacts to visitor use and experience because motorized access to the interior of the park would continue and would provide additional flexibility, including days of higher or lower OSV use, and the ability to share daily OSV allocations between entrance gates. Potential long-term negligible to minor adverse impacts could occur if the visitors' desired activity is not available at the desired time, or if a high use day prevents them from experiencing the desired resource condition (the ability to see wildlife or hear natural quiet).
- Alternative 7 would have long-term beneficial impacts to visitor use and experience because motorized access to the interior of the park would continue and variable use levels would allow visitors to plan their trip around their desired experience. Use levels would be similar to or lower than permitted under the 2009 interim rule, and would result in potential long-term minor to moderate adverse impacts if the visitors' desired activity is not available at the desired time. However, lower use levels should provide for improved resource conditions, and visitor enjoyment of those conditions, throughout the winter season.

DETAILED IMPACT ANALYSIS

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Under alternative 1, all snowmobile and snowcoach use in the park would end. Vehicle access would continue along the route from Cooke City to Gardiner (U.S. Highways 212 and 89), which is plowed during the winter months; however, other roadways in the park would be closed to vehicular traffic.

Two separate groups of park visitors would be affected by the change in management policies – motorized OSV users and non-motorized winter users.

Under alternative 1, opportunities to experience the park's interior by either snowmobile or snowcoach, an opportunity that has existed at various levels since the 1950s, would cease. For these visitors—who average more than 60,000 people per year— their desired winter visitor experience would no longer be available. Facilities in the interior of the park would be expected to close because reduced visitation would not be able to support the operation of lodges and the provision of other services. Guides would no longer be needed, the Visitor Center at Old Faithful would be closed, and there would be no need for warming huts to support visitor safety and experience.

Some visitors may choose to use a vehicle to access northern areas of the park for backcountry uses, such as snowshoeing and cross-country skiing. However, since the two uses differ greatly, the percentage of winter visitors likely to adapt to such a change in management policies is unknown. For the majority of Yellowstone winter visitors, ending access via snowmobile and snowcoach would result in parkwide, long-term major adverse impacts on the visitor use and experience.

Non-motorized users would likely experience both adverse and beneficial effects under alternative 1. By eliminating OSV access to the interior of the park, it is anticipated that the experiences of skiers and snowshoers would generally be focused on the fringes of the park or along the highway corridor in the northern part of the park. This reduced access would restrict opportunities to experience the park's geyser field, the Yellowstone River and Yellowstone Falls, iconic wildlife, and peace and solitude associated with the winter season. This would result in parkwide, long-term moderate to major adverse effects on visitor use and experience.

Benefits to non-motorized users may include increased opportunities to enjoy natural sounds and view wildlife. Noise and disturbance generated by snowmobile and snowcoach activities would be limited to those associated with park management and administration personnel. Therefore, such effects would generally be eliminated from the majority of the park and increase the chance to experience natural sounds. However, non-motorized visitors do not generally concentrate their activities in areas frequented by snowmobiles and snowcoaches, but rather in the backcountry where they can experience the natural sights and sounds of the park. Therefore, the benefits of reduced motorized use for non-motorized users would be limited, localized, and long-term.

The displacement of animals, in particular bison and elk, as a result of OSV-related noise and intrusion would be reduced to nearly zero by limiting OSV use to that associated with the management and administration of the park. Since access to the winter range would require long treks on skis or snowshoes, the frequency of human intrusion into this area would be infrequent. Visitors capable of making the trip to the winter range may have an increased wildlife experience, which would result in limited long-term benefits to their visitor experience.

Under alternative 1, the interior of the park would be closed to vehicular movements, thereby eliminating possible experiences for most visitors (though skiers and snowshoers could still access northern areas of the park but would have difficulty accessing the interior). This would result in a long-term major adverse effects on visitor use and experience.

Cumulative Impacts

Winter visitors to the park often enjoy a variety of experiences and include other destinations in their plans for visiting the area. In the greater Yellowstone area, there are numerous opportunities for winter users to recreate in national forests, view wildlife in wildlife refuges, and visit local communities such as Jackson and Cody, Wyoming, West Yellowstone, Gardiner, and Cooke City Montana, and Island Park and Ashton, Idaho.

Although such destinations may be included in a visitor's itinerary, the experiences inside Yellowstone are not available elsewhere. A wide range of activities exist in Yellowstone in the winter that includes photography, wildlife viewing, walking, skiing, and snowshoeing. Yellowstone has 35 miles of groomed trails, or for the adventurous, many miles of backcountry trails available for skiing or snowshoeing. Park concessioners operate lodging accommodations at Mammoth Hot Springs and Old Faithful and provide other services, including evening programs, snowmobile and snowcoach tours, guided ski and snowshoe tours, wildlife tours, a ski shop and repair center, massage therapy, hot tub rentals, and ice skating rinks. In addition, a yurt camp is available at Canyon, which is operated by one of the park's snowcoach outfitters. The NPS also provides ranger-led winter programs that offer insight into the history, culture, and geography of Yellowstone National Park. Winter programs begin when the park opens for the winter season December 15 and end on March 15. Until expiration of the 2009 interim rule, the availability of these services and experiences supported long-term benefits to winter visitor understanding and appreciation of park resources and values. These experiences have provided long-term beneficial impacts to visitors and would continue to provide beneficial impacts if continued into the future.

However, under alternative 1, only the northern portions of the park—Mammoth Hot Springs and Highways 212 and 89—would be accessible by motorized methods, and all OSV access would end. Visitor services at Old Faithful, Canyon, and other interior park locations would be closed, because OSVs serve as the conduit to these experiences. Thus, under alternative 1, because access would be limited, the availability of the experiences would be eliminated. The impacts of past, present, and reasonably foreseeable future winter experiences, combined with the long-term major adverse impacts of alternative 1, would result in long-term major adverse cumulative impacts on visitor use and experience, of which alternative 1 would constitute a large part.

Conclusion

Restricting winter access to the interior of the park by non-motorized means would result in long-term major adverse impacts on the visitor use and experience. Winter visitors desiring either or both non-motorized and motorized experiences would be affected by loss of access. Overall cumulative effects would be long-term major adverse.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Under alternative 2, the level of winter access permitted would remain the same under the 2009 interim rule. Primary park roads would continue to be used for motorized access with up to 318 snowmobiles and 78 snowcoaches permitted per day, the level of use permitted under the 2009 interim rule. Assuming an average of 1.3 riders per snowmobile and 8 visitors per snowcoach (based on past visitation numbers), the maximum number of visitors entering the park per day would be approximately 1,000. Guides and BAT OSVs would be required. Because visitor use in the interior of the park would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities that help support a safe and high-quality visitor experience would continue to be offered.

Compared to alternative 1, alternative 2 would offer a markedly improved visitor experience—with the exception of the small group of people who could ski the long distances between park entrances and attractions—because it would allow motorized access in the park to continue, which would increase the number of visitors able to access the park's interior features in the winter. The ability to tour the park by OSV would offer a variety of opportunities to enhance visitor experience, particularly where many park attractions would not otherwise be accessible. Requirements for using commercial guides and BAT snowmobiles under this alternative would support opportunities to view wildlife and scenery, generally safe touring conditions, access to park information, opportunities for quiet and solitude, and clean air, similar to the conditions that have prevailed in the park since the 2004 winter season.

Commercial guides are familiar with those areas where wildlife viewing is particularly good and routinely make impromptu stops to view wildlife and park scenery. They enforce proper touring behavior and usually provide informative commentary to their clients. Other information would continue to be available at warming huts, contact stations, visitor centers and entrance stations. Because commercially guided groups travel together and many such groups adhere to schedules that leave large periods of time free from OSV noise, periods of quiet and opportunities for solitude would continue. The requirement for using BAT technology would mean that good air quality in the park would also continue. For the majority of winter visitors, alternative 2 would provide long-term beneficial effects for visitor use and experience.

The presence of OSVs could cause wildlife to retreat from corridors where OSVs are used with the possibility of slightly reducing viewing opportunities. However, as described above under "Wildlife and Wildlife Habitat" the level of mechanized access proposed under alternative 2 would not be expected to result in large-scale changes in winter range use by park wildlife, and viewing opportunities would continue.

Visitors seeking non-motorized uses in the park would experience both beneficial and adverse effects. Users would benefit from continued access to the park's interior, maintenance of 35 miles of trails, and use of visitor services and amenities resulting in long-term beneficial effects on visitor experience and access. Localized adverse effects would occur from periodic exposure to OSV sounds and sights. As described in "Chapter 3: Affected Environment" (see "Soundscapes and Visitor Use and Experience"), these intrusions would not be expected to result in measurable reductions in visitor satisfaction or understanding and appreciation of park resources and values. Therefore, impacts to visitor use and experience for those seeking a non-motorized experience would be long-term, negligible to minor adverse.

The daily allocation of OSVs would be fixed under alternative 2. Although the daily allocations for snowmobiles and snowcoaches may not be met on a daily basis, capacity may be reached during traditionally busy periods. Fixed use limits could affect peak season winter visitors, especially on holidays and weekends. During periods of high visitation, some visitors may not be able to enter the park or have the experience they desire at a particular entrance, whereas capacity may be available at another entrance that they cannot access. This could occasionally diminish benefits associated with alternative 2.

Although some visitor expectations for OSV access to the park may not be met under alternative 2, implementation of this alternative would provide adequate access to meet OSV demand because permitted use levels would be the same as those maintained under the 2009 interim rule, which have not been met on a parkwide basis. Resource conditions on which visitor experience is in part dependent, including air quality and natural sounds, would largely be protected (see the "Air Quality" and "Soundscapes" sections). Although long-term minor adverse impacts associated with unmet expectations for some visitor groups during high visitation periods would persist, alternative 2 would result in long-term benefits to visitor use and experience.

Cumulative Impacts

Impacts on visitor use and experience from other past, present, and reasonably foreseeable future winter visitor experiences would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term beneficial impacts of alternative 2 would result in long-term beneficial cumulative impacts to visitor use and experience. Alternative 2 would make a large contribution to these impacts by offering traditional winter visitor use and experience opportunities in Yellowstone, a unique recreational opportunity in the area.

Conclusion

Under alternative 2, continuing OSV use and access in accordance with the 2009 interim rule limits would meet recent demand for winter visitation and provide limited opportunities for growth. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. Resource conditions (i.e., wildlife, soundscapes, and air quality), which support a quality visitor experience, would experience long-term negligible to moderate adverse effects. Therefore, alternative 2 would result in long-term benefits to visitor use and experience. Cumulative impacts to visitor use and experience under alternative 2 would be long-term and beneficial.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Under alternative 3, the level of OSV use permitted would be the same as described in the 2004 Winter Use Plan. Snowmobile use would increase over the levels allowed in the 2009 interim rule to up to 720 vehicles per day and snowcoach access would remain unchanged at 78 vehicles per day. Under this alternative, up to approximately 1,500 (an average of 1.3 per snowmobile and 8 per snowcoach) visitors could be expected to enter the park daily. Primary park roads would be used for motorized access. Commercial guides and BAT snowmobiles would be required. Since visitor use in the park's interior would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities supporting a safe, high-quality visitor experience would continue to be offered.

Alternative 3 would allow OSV access to the park's interior. The increase in the number of permitted snow vehicles would allow for a substantial increase in visitation during the winter season. OSVs would access the park's interior on groomed roadways and would have opportunities to experience a variety of winter activities, both motorized and non-motorized. The requirements for using commercial guides and BAT snowmobiles under this alternative would support opportunities to view wildlife and scenery, generally safe touring conditions, ready availability of information, and clean air. Overall, effects on visitor experience and access under alternative 3 would be long-term and beneficial.

Commercial guides are familiar with those areas that are particularly good for wildlife viewing and routinely make impromptu stops to visitors to view wildlife and park scenery. They enforce proper touring behavior and usually provide informative commentary to their clients. Additional information would continue to be available at warming huts, contact stations, visitor centers, and entrance stations. Since commercially guided groups travel together and many such groups adhere to schedules leaving large periods of time free from OSV noise, opportunities for quiet and solitude would remain. Additionally, the requirement for using BAT technology would limit impacts to air quality. OSV travel may degrade the quality of groomed surfaces somewhat (creating ruts and bumps on the surface of the snow); however, most visitors would experience the park on roads groomed on a regular basis.

As described above under "Wildlife and Wildlife Habitat," bison and elk may move away from OSV routes as OSV use levels increase due to the increased level of disturbance, thereby reducing wildlife viewing opportunities. A 2008 study that occurred during the time that up to 720 snowmobiles were permitted in the park, found that the opportunity to view bison was a large component of the winter experience, with 71% of respondents stating it was very important. Of those visitors that saw bison on their way to Old Faithful (99% of respondents), 21% indicated witnessing an encounter when the vision appeared hurried, took flight or was defensive (Freimund et al. 2009). However, the majority of visitors (72% to 78%) that witnessed these responses described them as acceptable/appropriate (Freimund et al. 2009). Additionally, the increased presence of OSVs would reduce opportunities for quiet and solitude – for both motorized and non-motorized users – as compared to alternative 1 and conditions that have been present for the past two winter seasons under the 2009 interim rule. The Freimund et al. study found that the opportunity to experience natural sounds at Yellowstone in the winter is important to the visitor experience. At use levels that would be similar to those under alternative 3, visitor satisfaction with natural sounds was high; 87% of respondents were “very satisfied” with their overall park experience and the remaining 13% were “satisfied” (Freimund et al. 2009). These incremental decreases in resource conditions, as well as past studies at similar use levels that show these resources conditions would be considered acceptable/appropriate, would result in long-term negligible to minor adverse effects to the visitor use and experience.

Visitors seeking non-motorized uses inside the park would experience both beneficial and adverse effects. Users would benefit from continued access to the park’s interior, maintenance of 35 miles of trails, and the use of visitor services and amenities. Limited adverse effects would occur from periodic exposure to OSV sounds and sights. With periods of noise intrusion over 35 dBA, and permitted use levels more than doubling compared to what has occurred the past two winter seasons, the ability to appreciate park resources and values would be impacted for these visitors and could result in long-term minor adverse effects.

The daily allocation of OSVs would be fixed under alternative 3. Although the daily allocations for snowmobiles and snowcoaches may not be met on a daily basis, capacity could be reached during traditionally busy periods. This would affect peak season winter visitors, particularly on holidays and weekends. Some visitors may not be able to enter the park or have the experience they desire. This could diminish overall visitor access benefits associated with alternative 3.

Visitors would experience long-term minor adverse impacts under alternative 3. These impacts would result from increased use levels that could adversely affect park resources, and in turn, diminish the visitor experience. Non -motorized users may experience decreased satisfaction with increased OSV use. However, due to the high levels of use permitted and the ability of visitor to experience Yellowstone in the winter in a variety of ways, long-term beneficial impacts would also occur.

Cumulative Impacts

Impacts on visitor use and experience from other past, present, and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term minor adverse impacts and long-term beneficial impacts of alternative 3, would result in long-term beneficial cumulative impacts to visitor use and experience. Alternative 3 would make a large contribution to these impacts by supporting traditional winter visitor use and experience opportunities in Yellowstone, a unique recreational opportunity in the area.

Conclusion

Under alternative 3, increasing OSV numbers and allowing access in accordance with the 2004 plan limits would provide opportunities for OSV users to experience Yellowstone in the winter, and would allow for some growth in OSV use as compared to what was observed between 2004 and 2009. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior, but all users could experience a decrease in satisfaction because resources could be impacted by increased OSV use. Resource conditions (i.e., wildlife and soundscapes) would be affected to a greater extent than in recent years and may affect the ability to view wildlife and experience natural sounds. Overall, alternative 3 would result in long-term benefits to visitor experience and access, with long-term minor adverse impacts occurring from any decrease in visitor satisfaction. Cumulative impacts to visitor use and experience under alternative 3 would be long-term and beneficial.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Under alternative 4, winter access would be managed differently for different vehicle types to various parts of the park. A portion of the main park road system from Mammoth to Madison and from the west entrance to Old Faithful would be plowed to allow commercial wheeled-vehicle access. From the south entrance to Old Faithful and from West Thumb to Norris would be groomed for OSV use. Up to 66 snowmobiles and 20 snowcoaches could enter from the south each day. Up to 100 multi-passenger, commercial vehicles would be allowed to enter from the north and west; no private wheeled vehicles would be permitted. Limited snowmobile use (22 per day) would be allowed at Old Faithful and Norris. The east entrance would be closed to motorized use.

Because visitor use in the park's interior would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities that help support a safe and high-quality visitor experience would continue to be offered. Under this alternative, the total number of visitors inside the park could increase. Vans and buses could easily transport up to 2,000 visitors into the park each day. Including OSV users, total visitation could be expected to range up to over 2,300 per day. It is anticipated that commercial providers would provide wheeled-vehicle visitor experiences along the plowed roadways. This could include experiences in geologically active areas from Old Faithful and north through the Geyser Basin to Norris. Overnight stays at Old Faithful Snow Lodge would also be expected to increase should visitation to the park increase. For those entering in wheeled vehicles, once inside the park, access to sites beyond plowed roads and developed visitor areas would be restricted to backcountry methods on snowshoes and skis (as under the 2009 interim rule) and limited availability of OSVs from Norris or Old Faithful.

Under alternative 4, visitors seeking OSV and non-motorized would likely experience mixed beneficial and adverse effects. OSV use would continue, but reduced capacity numbers from under 2009 interim rule use levels would impact the ability to access a variety of experiences in the park as compared to historical levels. Commercial guides and BAT OSVs would be required. Snowmobiles (up to 110 per day) and snowcoaches (up to 30 per day) may not meet demand (based on use levels for the 2009/2010 winter season) and would not be able accommodate any growth in demand for OSV use in the park. Under this alternative, OSV routes would be reduced and "loop tour" experiences eliminated. Such a change would be beneficial as compared to alternative 1 but would not provide a level of visitor access consistent with those in place under the 2009 interim rule and historical use rates (see table 37). As a result, it is not anticipated that the user levels permitted under this alternatives would meet expectations for the majority of winter visitors.

As described above under "Wildlife and Wildlife Habitat," opportunities to view bison and elk would continue along plowed roadways, because these species do not generally disperse as a result of the presence of wheeled vehicles. However, the frequent presence and operation of snowplows to maintain road access could degrade natural quiet for both animals and visitors.

Winter visitors seeking non-motorized recreation could access the park by both wheeled vehicles and OSVs. Accessing the park by these different vehicle types would lead to distinctive experiences; each type of vehicle would be able to access distinct park environments and settings. Further, the addition of wheeled vehicle access would add an access opportunity that would likely be more financially affordable to visitors than OSV use. For the areas east of Old Faithful and Norris, backcountry visitors would likely experience increased quiet because the total number of OSVs would be dramatically reduced. This may improve wildlife viewing and increase opportunities to appreciate solitude and the park's winter resources. Cross-country skiers and snowshoers visiting areas west of Old Faithful and Norris would access trailheads via wheeled vehicles on plowed roads. The park would continue to maintain 35 miles of backcountry trails and would add 10 miles of trails made accessible from the plowed roads.

Compared to alternative 1, alternative 4 would offer a distinctively different visitor experience. The addition of wheeled-vehicle access combined with continued but limited ability to tour the park by OSV would create opportunities to have an enjoyable visitor experience. However, this may not meet visitor expectations for exploring the park by OSV, resulting in long-term minor to moderate adverse impacts, because the difference in experience would be noticeable and measureable for this specific group of visitors. The requirements to use commercial vehicles, guides, and BAT snowmobiles under this alternative would support opportunities to view wildlife and scenery, generally safe touring conditions, ready availability of information, and clean air. OSV noise would decrease to approximately half of that under the 2009 interim rule on and near travel corridors.

Adverse impacts to visitor use and experience would continue under alternative 4 because the expectation for OSV access to the park would likely not be met. However, a new winter visitor experience would be added with wheeled vehicle use, creating beneficial effects. Although adverse impacts would persist, compared to alternative 1, overall impacts on visitor use and experience would be long-term beneficial, with long-term minor to moderate adverse impacts to those visitors impacted by the limited availability of OSV.

Cumulative Impacts

Impacts on visitor use and experience from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term minor to moderate adverse impacts and long-term beneficial impacts of alternative 4, would result in long-term minor to moderate adverse impacts and long-term beneficial cumulative impacts to visitor use and experience. Alternative 4 would make a large contribution to these impacts by supporting traditional winter visitor use and experience opportunities in Yellowstone, a unique recreational opportunity in the area.

Conclusion

Under alternative 4, changes in visitor access and experience created by introducing wheeled vehicles access and limiting OSV access would result in a distinctively different winter visitor experience. Parkwide, long-term beneficial impacts would result compared with alternative 1. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. However, expectations for OSV access and experience would not likely be met because of the decrease in the number of snowmobiles and snowcoaches permitted in the park on any given day, resulting in long-term moderate adverse impacts for this user group. Overall, alternative 4 would result in long-term beneficial impact and long-term minor to moderate adverse impacts to visitor experience and access. Cumulative impacts to visitor use and experience would be long-term minor to moderate adverse and long-term beneficial.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

At the implementation of this alternative, this alternative would have the same use levels as under alternative 2 (up to 318 snowmobiles and 78 snowcoaches) and therefore the impacts would be the same. Beginning in the 2014/2015 winter season, BAT snowcoach access would be allowed to increase over a 5-year period from the 2009 interim rule level of up to 78 vehicles per day to 120 vehicles per day. Snowmobile use would correspondingly decrease from the 2009 interim rule use level of up to 318 vehicles per day to zero over the 5-year period; the decrease in snowmobiles would be based on the demand for snowcoaches or at the Superintendents discretion. Assuming eight visitors per snowcoach, a total daily visitation rate of 960 visitors could be expected if a full phase out were to occur. Requirements for BAT snowmobiles and guided activities would continue throughout the transition period with all new snowcoaches required to have BAT. Primary park roads would be groomed for OSV use. Since visitor use in the park's interior would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities that help support a safe, high-quality visitor experience would continue to be offered.

Compared to the alternative 1, alternative 5 would offer an improved visitor experience. However, a specific, individual winter experience in the park, one that has been available for many years, would be phased out and replaced by a group experience. Although attractions and destinations would remain accessible and interpretation provided through guides, the sense of adventure associated with riding a snowmobile, which includes being exposed to the winter weather with no barrier between the visitor and the environment, would be lost. For those visitors seeking this type of experience, the removal of snowmobile use from the park would result in long-term, moderate, adverse effects on visitor experience.

During the 5-year transition period, the requirements for using commercial guides and BAT snowmobiles would support opportunities to view wildlife and scenery, generally safe touring conditions, ready availability of information, good opportunities for quiet and solitude, and clean air. This would be similar to the conditions that have prevailed in the park since the 2004 winter season. Commercial guides are familiar with typical wildlife viewing locations and routinely make impromptu stops to view wildlife and park scenery. They enforce proper touring behavior and usually provide informative commentary to their clients. Other information would continue to be available at warming huts, contact stations, visitor centers, and entrance stations. Requirements for BAT technology for snowcoaches would support good air quality.

Visitors seeking non-motorized uses inside the park would experience limited beneficial effects. The total number of OSVs in the park would be reduced to the number of snowcoaches permitted in the park on a given day. It is anticipated that this would result in a small reduction in OSV sounds exceeding 35 dBA in the travel corridor (from approximately 9 percent to 6 percent of the day) as compared to the combined presence of snowmobiles and snowcoaches. As a result, backcountry visitors may experience an increment of improved opportunities to experience quiet and solitude. These visitors would continue to benefit from continued access to the park's interior, maintenance of 35 miles of trails, and use of visitor services and amenities such as warming huts. Limited adverse effects would continue to occur from periodic exposure to snowcoach sounds and sights. As described in the Affected Environment (see "Soundscapes" and "Wildlife and Wildlife Habitat"), these intrusions would be considered minimal.

The daily allocation of snowcoaches provided under alternative 5 would be fixed and the 120 snowcoach maximum should a full phase out occur and may not meet demand during traditionally busy periods or allow for increased visitation. This could affect peak season winter visitors, particularly on holidays and weekends. As a result, some potential visitors may not be able to enter the park or have the experience they desire, possibly diminishing overall benefits associated with alternative 5 for those potential visitors. Visitors would be able to engage in OSV use in other areas in the region, but the specific experience of OSV use in Yellowstone would be more limited.

Some visitor expectations for the type and amount of OSV access to the park may not be met under alternative 5. Additionally, the implementation of this alternative may not meet demand (based on use levels for the 2009/2010 winter season) or allow for increased winter visitation to the park. Resource conditions that contribute to visitor experience (e.g., air quality and natural sounds) would largely be protected under this alternative. Although minor adverse impacts associated with unmet expectations of some visitor groups would continue or increase with the elimination of snowmobile use, when compared to alternative 1, alternative 5 would result in long-term benefits to visitor use and experience with long-term moderate adverse impacts to users who can no longer have an individual OSV (snowmobile) experience in the park.

Cumulative Impacts

Impacts on visitor use and experience from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term moderate adverse impacts and long-term beneficial impacts of alternative 5 would result in long-term moderate adverse impacts and long-term beneficial cumulative impacts to visitor use and experience. Alternative 5 would make a large contribution to these impacts by supporting traditional winter visitor use and experience opportunities in Yellowstone, a unique recreational opportunity in the area.

Conclusion

Under alternative 5, changes in visitor experience created by the potential transition to snowcoach access only would result in parkwide, long-term benefits compared to the no-action alternative. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior. However, the opportunity to experience a specific, individual snowmobile experience as offered in the past would be lost. This would result in the potential for visitors' expectations not to be met. Overall, alternative 5 would result in long-term beneficial impacts to visitor experience and access, with long-term moderate adverse impacts to those wishing to engage in snowmobile use. Cumulative impacts to visitor use and experience would be long-term beneficial and long-term moderate adverse.

Impacts of Alternative 6: Implement Variable Management

Under alternative 6, winter access would be managed to increase a variety of winter experiences, create flexibility in use levels, and add opportunities for backcountry skiing and snowshoeing. Up to 540 snowmobiles and 78 snowcoaches would be permitted in the park daily, but this number could vary on a daily basis, based on a per-determined winter use schedule. Approximately 1300 visitors per day could be expected under this alternative. Entrance gate allocations would be flexible and incentives for use of new technology would be developed. Up to 25% of snowmobile use would be unguided or non-commercially guided, with requirements for completing a snowmobile education and safety course, with the remaining OSV allocations being commercially guided. In addition, a variety of additional snowmobile routes would be made available based on a seasonal schedule. Since visitor use in the park's interior would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities that help support a safe and high-quality visitor experience would continue to be offered. Under this alternative, visitors would have increased opportunities for exploring Yellowstone using OSVs with use limits that would increase use from 2009/2010 winter season levels. Depending on snow conditions, availability of alternate routes, and service provider capacities, visitors would have increased flexibility in visiting the park during winter. Traditional vacation /holiday periods and long weekends would likely see higher demand with the potential to meet maximum OSV capacity in some years, and lower OSV levels in other years. However, the use of alternate routes, availability of unguided/non-commercially guided snowmobiling, and the ability of operators to exchange permits would alleviate potential crowding by allocating use based on visitor demand and defined capacities in various areas.

Depending on demand, the total number of visitors inside the park could potentially increase. Peak season visitation during holidays could reach capacity. Visitors seeking OSV experiences would likely experience beneficial effects from alternative 6. Availability of snowmobile tours would be increased, visitors with their own snowmobiles that meet BAT requirements would have access to the park under the unguided/non-commercially guided system, and snowcoach access would continue. Commercial guides and BAT snowmobiles would be required for all other OSV use. This would be beneficial and would provide a level of visitor access consistent with historical use rates and would allow the flexibility to meet changing demands. It is anticipated that this alternative would meet the expectation of most OSV visitors.

As described under “Wildlife and Wildlife Habitat,” bison and elk may move away from OSV routes as OSV use levels increase should they find the sound of OSVs or human interaction bothersome, possibly reducing wildlife viewing opportunities. A 2008 study that occurred during the time that up to 720 snowmobiles were permitted in the park found that the opportunity to view bison was a large component of the winter experience, with 71% of respondents stating it was very important. Of those visitors that saw bison on their way to Old Faithful (99% of respondents), 21% indicated witnessing an encounter when the bison appeared hurried, took flight or was defensive. However, the majority of visitors (72% to 78%) that witnessed these responses described them as acceptable/appropriate (Freimund et al. 2009). In addition, the increased presence of OSVs would reduce opportunities for quiet and solitude—for both motorized and non-motorized users—as compared to alternative 1 and conditions that have been present for the past two winter seasons. At use levels that would be similar to those under alternative 3, Freimund et al. (2009) found that the opportunity to experience natural sounds at Yellowstone in the winter is important to the visitor experience and satisfaction with natural sounds was high, with 87% of respondents being “very satisfied” with their overall park experience and the remaining 13% were “satisfied” (Freimund et al. 2009). OSV noise would exceed 35 dBA in travel corridors for approximately 13 to 14 percent of the day – more than double that of the 2009 interim rule conditions. For backcountry visitors, the increase in the total number of OSVs allowed in the park from 396 vehicles per day to 618 vehicles per day (on a high use day) could result in a modest reduction in opportunities to experience natural sounds and solitude. However, alternative 6 provides for variability in use throughout the season. This variability would allow users to plan their trip around their desired experience. If OSV noise would detract from a visitor experience, that visitor can plan a visit for a time with lower OSV use. If OSV use is a critical part of a visitor experience, the visitor can plan for a day with higher OSV use; past studies have found that although high level of use may have some adverse impact to the visitor experience, there is a high level of visitor satisfaction, as described above (Freimund et al. 2009). This flexibility would result in long-term beneficial impacts, with the potential for long-term negligible to minor adverse impacts if these individual desires cannot be accommodated.

Alternative 6 has the greatest potential to meet expectations of OSV visitors to the park. Also associated with this alternative would be a small increase in adverse impacts to other visitors and park resources. Compared to alternative 1, overall impacts on visitor use and experience would be long-term beneficial, with long-term negligible to minor adverse impacts to those who would not be able to achieve their desired visitor experience because of increased use levels, although these users could plan for days where the desired experience is provided. These impacts to visitor use and experience would be similar to greater than those under the 2009 interim rule.

Cumulative Impacts

Impacts on visitor use and experience from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term negligible to minor adverse impacts and long-term beneficial impacts of alternative 6 would result in long-term minor adverse impacts and long-term beneficial cumulative impacts to visitor use and experience. Alternative 6 would make a large contribution to these impacts by supporting traditional winter visitor use and experience opportunities in Yellowstone, a unique recreational opportunity in the area.

Conclusion

Under alternative 6, increases in OSV allocations and flexibility in daily use would result in parkwide, long-term beneficial impacts compared to the no-action alternative. Both motorized and non-motorized winter users would experience the benefits of continued access to the park's interior, and visitors could plan their trip around the use level for that day and their desired experience. Resource conditions (e.g., wildlife and soundscapes) would be affected to a greater extent than in recent years, somewhat affecting the visitors' ability to view wildlife and experience natural sounds. Overall, alternative 6 would result in long-term benefits to visitor experience and access, with potential negligible to minor impacts for visitors that cannot accommodate their desired experience. Cumulative impacts would be long-term minor adverse as well as long-term beneficial.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Under alternative 7, the number of snowmobiles and snowcoaches permitted in the park would vary, allowing higher use during peak demand periods. Up to 330 snowmobiles and 80 snowcoaches could enter the park during the winter season. During times when the permitted use levels are lower, up to 220 and 143 snowmobiles, and 50 and 30 snowcoaches, respectively, could enter the park to allow for variation in use. All snowmobile and snowcoach use in the park would be commercially guided. Under this alternative, all OSVs would be required to enter the park before 10:30 a.m. each day. A maximum of approximately 1,070 OSV visitors per day (on a high use day) could be expected under this alternative. All entrance gate allocations would be flexible and could be transferred between gate locations. BAT would be required for all OSVs by the 2014/2015 winter use season, with additional BAT requirements for NO_x to be developed. Because visitor use in the park's interior would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities that help support a safe and high-quality visitor experience would continue to be offered. Increased access would be provided to cross country skiers and snowshoers by conversion of several OSV routes to non-motorized use. These routes include Firehole Canyon, North Canyon Rim Drive, and Riverside Drive.

Under this alternative, the variety of available winter use experiences would be expanded, and OSV numbers permitted and access locations would be flexible. It is anticipated that current OSV demand would be met, and limited growth could be accommodated. Thus, alternative 7 would provide long-term, parkwide benefits for OSV visitors. However, the OSV visitor experience would be altered from that available in past winter seasons, especially for lower use days. OSVs would have limited access in the beginning and end of the winter season, potentially reducing available visitation dates. OSV visitors would have only commercially guided touring opportunities, and would have reduced ability to view high-value features seen along routes converted to non-motorized use. Some visitors may not be able to visit at the desired time or experience a specific park landscape and resource. For OSV users, the benefits of alternative 7 would be offset somewhat by long-term, localized, minor to moderate, adverse effects of these restrictions.

Alternative 7 has the greatest potential to meet expectations of non-motorized winter users of the park. Cross-country skiers and snowshoers would gain access to routes previously shared with OSVs, and would have the new opportunities to experience park resources and values with low levels of OSV noise and intrusion. Alternative 7 would result in long-term, parkwide, benefits for park visitors pursuing non-motorized means of recreation.

The overall reduction in the number of OSVs, compared to historical numbers, and reduced access to portions of the park would increase opportunities for quiet and solitude for both motorized and non-motorized users for half of the winter use season. OSV noise would exceed 35 dBA in travel corridors for approximately 12% to 9% of the day, similar to those levels experienced in the winter of 2009/2010. The variability in numbers of OSVs in the park would allow users to plan their trip around their desired experience. If OSV noise would detract from a visitor’s experience, that visitor can plan a visit for a time with lower OSV use; if OSV use is a critical part of a visitor’s experience, they can plan for a day with higher OSV use. This flexibility could result in long-term beneficial impacts, with the potential for long-term negligible to minor adverse impacts if these individual desires cannot be accommodated.

Also associated with alternative 7 are somewhat reduced impacts to wildlife from reduced OSV numbers for half of the winter use season, elimination of OSVs on some routes, and requiring all OSVs to enter the park by 10:30 a.m. (clumping use). In combination with reduced OSV noise, it is anticipated that wildlife would be affected to a lesser extent than in recent years, and opportunities for viewing may be improved.

Compared to alternative 1, overall impacts on visitor use and experience would be long-term beneficial, with long-term, minor to moderate, adverse impacts for those visitors unable to achieve their desired visitor experience because of reduced OSV availability and route changes.

Cumulative Impacts

Impacts on visitor use and experience from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term minor to moderate adverse impacts and long-term beneficial impacts of alternative 7 would result in long-term minor to moderate adverse impacts and long-term beneficial cumulative impacts to visitor use and experience. Alternative 7 would make a large contribution to these impacts by supporting traditional winter visitor use and experience opportunities in Yellowstone, a unique recreational opportunity in the area.

Conclusion

Under alternative 7, varying OSV allocations and flexibility in daily use would result in parkwide, long-term beneficial impacts compared to the no-action alternative. Visitors could plan their trip around desired use and experiences, but limited OSV availability early and later in the winter season may result in unmet expectations for OSV visitors. Resource conditions (soundscapes and wildlife) would be affected to a lesser extent than in recent years, somewhat improving visitors’ ability to view experience natural sounds and view wildlife. Overall, alternative 7 would result in long-term benefits to visitor experience and access, with potential minor to moderate adverse impacts for visitors that cannot obtain their desired experience. Cumulative impacts would be long-term, minor to moderate, adverse, as well as long-term beneficial.

VISITOR ACCESSIBILITY

GUIDING REGULATIONS AND POLICIES

It is NPS policy to ensure that all people, including those with disabilities, have the highest reasonable level of accessibility to NPS programs, facilities and services. NPS *Management Policies 2006* emphasize the need to comply with the Americans with Disabilities Act (ADA) and Architectural Barriers Act in Section 5.3.2, "Physical Access for Persons with Disabilities" and Sections 1.9.3, 8.4.2, and 9.1.2 "Accessibility for Persons with Disabilities." Other mandates include the requirement for providing reasonable accommodation for known disabilities of qualified applicants and employees (Director's Order 16A, Reasonable Accommodation for Applicants and Employees with Disabilities) and to ensure that facilities are readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs (Director's Order 42, Accessibility for Visitors with Disabilities in National Park Service Programs and Services).

In addition, the NPS requires that those providing commercial services in the parks share the NPS responsibility to provide employees and visitors with the greatest degree of access to programs, facilities, and services that is reasonable, within the terms of existing contracts and agreements (see NPS *Management Policies 2006*, sec. 10.2.6.2 "Accessibility of Commercial Services").

ASSUMPTIONS, METHODOLOGY, AND INTENSITY DEFINITIONS

This section includes an analysis of changes to accessibility for the very young, the elderly, and those with mobility impairments. For the very young and the elderly, mobility issues were not considered to be of primary concern; rather, exposure to winter weather, including cold temperatures and high winds, and the need for protection from these elements were considered. Resources considered in the analysis include opportunities to view wildlife and scenery in a safe environment.

For this analysis, it is assumed that the experience of visiting Yellowstone by snowcoach would be available for the very young, elderly, and mobility impaired visitors. In addition, snowmobile use would be possible for some portion of those visitors with disabilities. Therefore, snowcoach and snowmobile use are considered in this analysis. It is also assumed that those providing commercial tours in the park are in compliance with NPS accessibility requirements as mentioned above. This includes larger capacity snowcoaches offering wheelchair accessibility and/or ramps.

The following definitions for evaluating impacts on visitor accessibility were defined.

Negligible: Accessibility for the very young, the elderly, and individuals with disabilities would not be affected, or effects would not be noticeable or measurable. There would be minimal effects on safe opportunities to view wildlife and scenery.

Minor: Changes in accessibility would be noticeable, but would affect only a small portion of the very young, the elderly, and individuals with mobility-related disabilities who visit the park. Impacts would be slight without appreciably limiting or enhancing critical characteristics of opportunities to safely view wildlife and scenery.

Moderate: Changes in accessibility would be readily apparent to many of the very young, the elderly, and individuals with mobility-related disabilities who use the park. Visitors would have some difficulty finding available, safe opportunities to view wildlife and scenery.

Major: The effects on accessibility would be readily apparent to most of the very young, the elderly, and individuals with mobility-related disabilities who use the park and would substantially change their ability to access park features. Visitors would frequently have substantial difficulty finding available, safe opportunities to view wildlife and scenery.

Study Area

The geographic study area for visitor accessibility analysis includes the entire area within the park boundary.

SUMMARY OF IMPACTS

Impacts to visitor access under the alternatives ranged from long-term major adverse under the no-action alternative to long-term and beneficial under the action alternatives because the levels and types of OSV use allowed for greater access into the interior of the park. Impacts under each alternative were as follows:

- Alternative 1 would have long-term major adverse impacts by restricting winter access to the interior of the park to non-motorized methods.
- Alternatives 2, 3, 4, 5, 6, and 7 would have long-term beneficial impacts because allowing OSV into the interior of the park would provide opportunities for accessibility. However, under alternative 4, the potential for long-term minor adverse impacts would exist because the number of OSVs would be limited, thereby potentially limiting the number of accessible OSVs.

DETAILED IMPACT ANALYSIS

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Under alternative 1, no public OSV use would be allowed in the park. Vehicle access would continue along the route from Cooke City to Gardiner (U.S. Highways 212 and 89), which is plowed during the winter months (NPS 2010c).

Under alternative 1, access for all visitors—both those with and without accessibility needs—to the park's interior would be limited to those capable of snowshoeing or cross-country skiing into the park. In addition, visitor services and amenities within the park would be severely reduced or eliminated. For the very young, elderly, and those that are mobility impaired, this would result in a loss of opportunity to experience the park's iconic features of Old Faithful, the Geyser Basin, and Yellowstone River and Yellowstone Falls, among others. This would result in long-term, major adverse impacts for those users with accessibility needs.

Cumulative Impacts

As described in the section "Visitor Use and Experience," Yellowstone offers a range of accessible winter visitor experiences, including snowcoach access to photography opportunities and wildlife viewing. Park concessioners operate lodging accommodations at Mammoth Hot Springs and Old Faithful and provide other services, including evening programs, snowcoach tours, wildlife tours, massage therapy, and hot tub rentals. In addition, a yurt camp is available at Canyon, which is operated by one of the park's snowcoach outfitters. The NPS also provides ranger-led winter programs that offer insight into the history, culture, and geography of Yellowstone National Park. Winter programs begin when the park opens for the winter season on December 15 and end on March 15. Until expiration of the 2009 interim rule, the availability of these services and experiences supported long-term benefits to winter visitor understanding and appreciation of park resources and values.

The long-term beneficial impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term major adverse impacts of alternative 1, would result in long-term major adverse cumulative impacts on visitor accessibility. Alternative 1 would constitute a large part of these impacts because access to the interior of the park would impact all visitors to Yellowstone.

Conclusion

Restricting winter access to the interior of the park to non-motorized methods would result in long-term major adverse impacts to visitor accessibility; including the very young, the elderly, and the mobility-impaired visitors. Accessible regional opportunities for winter recreation would offset these adverse impacts somewhat. Cumulative impacts to visitor accessibility would be long-term major adverse, to which alternative 1 would contribute a large part.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Under alternative 2, the level of winter access permitted would be similar to the 2009 interim rule. The main park roads would be groomed for OSV access, which includes a daily limit of up to 78 snowcoaches per day. This would also provide access for snowcoaches equipped with ramps/lifts to accommodate wheelchairs. Mobility impaired visitors capable of operating snowmobiles would have access to this traditional winter activity, and wheelchairs can be transported via snowmobile. In addition, small children could be accommodated on snowmobiles with their parents, providing an exciting and cost effective way for families to experience Yellowstone in winter. Accessible facilities in the park would continue to be available to support a safe and, informative park experience for the very young, the elderly, and the mobility impaired. Once in the park, a variety of accessible facilities would be available to support the traditional winter use experience for those with accessibility needs; including facilities near Old Faithful found at the Snow Lodge and the visitor center. While touring by snowcoach and snowmobile, the Canyon can be viewed from accessible locations on the South Rim Drive at Artist Point and at Uncle Tom's Overlook. In addition, Fishing Bridge is partially wheelchair accessible.

Compared to alternative 1, alternative 2 would offer a markedly better experience for those with accessibility needs. The continued ability to tour the park by OSV would offer a variety of opportunities to have a safe, informative, and enjoyable experience. This alternative would support guided opportunities to view wildlife and scenery, ready availability of information, opportunities for quiet and solitude, and clean air, similar to the conditions that have prevailed in the park over the last four winters. As of December 2010, the demand for snowcoach ramp/lift capabilities was being met by service providers with equipment suitable to meet these needs. It is anticipated that service providers would expand equipment capabilities to meet an increase in demand should it be necessary in the future.

For the very young, the elderly, and the mobility-impaired winter visitors, alternative 2 would provide parkwide, long-term beneficial impacts on accessibility.

Cumulative Impacts

Impacts on visitor accessibility from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term beneficial impacts of alternative 2 would result in long-term beneficial cumulative impacts to visitor accessibility. Alternative 2 would make a large contribution to these impacts by supporting accessible winter visitor use and experience opportunities in the park, a unique recreational opportunity in the area.

Conclusion

Under alternative 2, continuing OSV numbers and routes in accordance with the 2009 interim rule limits would meet demand (based on use levels for the 2009/2010 winter season) for accessible winter visitation for the very young, the elderly, and the mobility impaired. Opportunities for increased visitation for those with mobility needs would also be accommodated. Thus, alternative 2 would result in long-term beneficial impacts to visitor accessibility. Cumulative impacts under alternative 2 would be long-term and beneficial.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Under alternative 3, winter use levels as described in the 2004 Winter Use Plan would continue, permitting up to 78 snowcoaches per day in the park. As described for alternative 2, snowmobile touring would also be available for those seeking this specific winter use experience. Primary park roads would be groomed for OSV access, including those suitable for wheelchair use and those with ramps/lifts. Accessible facilities in the park would continue to be available to support a comfortable and informative park experience for the very young, the elderly, and mobility impaired. As described for alternative 2, the park’s accessible facilities would support a safe and educational experience for those with mobility needs. It is anticipated that existing demand would be met with additional capacity for an increase in accessible services. Within the park, accessible facilities at a variety of locations would support traditional winter experiences for those with accessibility needs. Alternative 3 would result in parkwide long-term benefits for visitor accessibility.

Cumulative Impacts

Impacts on visitor accessibility from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These and long-term beneficial impacts, when combined with the long-term beneficial impacts of alternative 3 would result in long-term beneficial cumulative impacts to visitor accessibility. Alternative 3 would make a large contribution to these impacts by supporting accessible winter visitor use and experience opportunities in the park, a unique recreational opportunity in the area.

Conclusion

Under alternative 3, OSV numbers and routes in accordance with the 2004 Winter Use Plan limits would meet the demand (based on use levels for the 2009/2010 winter season) for a winter experience that can be enjoyed by the very young, the elderly, and the mobility impaired. Opportunities for increased accessible visitation would also be accommodated. Therefore, alternative 3 would result in long-term benefits to visitor accessibility. Cumulative impacts under alternative 3 would be long-term and beneficial.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Under alternative 4, winter access would be managed for different vehicle types with different regulations by section of the park. Part of the main park road system from Mammoth to Madison and from the west entrance to Old Faithful would be plowed to allow commercial wheeled-vehicle access. The area from the south entrance to Old Faithful and from West Thumb to Norris would be groomed for OSV use. Up to 20 snowcoaches, along with up to 66 snowmobiles per day could enter from the south each day. Up to 100 multi-passenger, wheeled, commercial vehicles would be allowed to enter the park from the north and west (no private wheeled vehicles would be permitted). The east entrance would be closed to motorized use. Accessible facilities in the park would continue to be available to support a comfortable and informative park experience for the very young, the elderly, and the mobility impaired. This alternative provides the greatest potential for including a variety of accessible experiences for winter visitors. Allowing for wheeled access to portions of the park would expand the variety of vehicles that provide safe, ADA-compliant visitor transportation and guided tour services within the park. Commercial service providers could employ vans and shuttle buses used during the summer season for a portion of their winter services, avoiding the expense of converting other vehicles to meet ADA compliance requirements. Wheeled vehicle experiences could include the geologically active areas from Old Faithful north through the Geyser Basin to Norris. From the west entrance, visitors would travel along the Madison River introducing a new accessible winter experience that does not require OSV travel.

However, for those seeking accessible snowcoach and snowmobile touring, availability could be limited as compared to other alternatives. Although OSV use would continue, available experiences would be dramatically reduced compared to historical levels. Allowing OSV entry only from the south would localize availability, may not meet current overall demand, and is not anticipated to accommodate an increased demand for such services. Therefore, it could be more difficult for those with accessibility needs to have an OSV experience in the park. In addition, OSV routes would be reduced and “loop tour” experiences eliminated. This alternative would be beneficial for accessibility compared to alternative 1, but may not provide accessible visitor experiences consistent with historical use. Such effects would be experienced by all park users – both those with and without accessibility needs. As described for alternative 2, within the park, accessible facilities at a variety of locations would support a safe and informative winter experience for those with accessibility needs.

Compared to alternative 1, alternative 4 would offer distinctive accessibility options providing long-term beneficial impacts. The addition of wheeled-vehicle access combined with the continued but limited ability to tour the park by OSV would create opportunities to have an enjoyable accessible experience; however, it may not meet expectations for exploring the park by snowcoach or snowmobile and could also result in long-term minor adverse impacts if accessible OSV demand cannot be met.

Cumulative Impacts

Impacts on visitor accessibility from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term beneficial impacts and long-term minor adverse impacts of alternative 4 would result in long-term beneficial cumulative impacts to visitor use and experience. Alternative 4 would make a large contribution to these impacts by supporting accessible winter visitor use and experience opportunities in the park, a unique recreational opportunity in the area.

Conclusion

Under alternative 4, distinct accessibility options of snowcoaches, snowmobiles, and wheeled vehicles would be available for exploring Yellowstone in winter. However, accessible snowcoach experiences may not be available to all seeking them. Nonetheless, the availability of wheeled, accessible vehicles would potentially provide the greatest degree of accessibility of the proposed alternatives. This would result in parkwide, long-term beneficial impacts to accessibility when compared to the no-action alternative, with the potential for long-term minor adverse impacts due to the limited availability of snowcoach access. Cumulative impacts would be long-term beneficial.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Impacts under alternative 5 upon plan implementation would be the same as alternative 2. Beginning in the 2014/2015 winter season, BAT snowcoach access would increase over a 5-year period from the 2009 interim rule level of up to 78 vehicles per day to 120 vehicles per day, based on user demand. Snowmobile use would correspondingly decrease to zero over the 5-year period if user demand for snowcoaches exists or at the discretion of the Superintendent. The main park roads would be groomed for OSV use. Accessible facilities in the park would continue to be available to support safe and informative park experiences for the very young, the elderly, and the mobility impaired. Following the 5-year transition period, the daily allocation of snowcoaches provided under alternative 5 would be fixed. Snowcoaches would enter the park from a variety of locations. Given that there had been unused capacity under the 2009 interim rule for accessible snowcoach tours, the increase would allow for substantial growth in services of ADA-compliant snowcoaches, if demand increases.

However, with elimination of snowmobile use in the park, the opportunity for this experience would be lost. In addition, with only the option of snowcoach touring, alternative 5 would have the potential to increase the cost of winter use experiences for families with small children. This would result in long-term, minor to moderate adverse effects to this specific group of visitors with accessibility needs. As described for alternative 2, within the park, accessible facilities at a variety of locations would support a safe and comfortable experience for those with accessibility needs.

Alternative 5 offers the greatest potential for the very young, the elderly, and the mobility impaired to experience an informative “over the snow” adventure in the winter landscape of the park via snowcoach. However, the opportunity to use snowmobiles would be eliminated over the long term. Although there would be minor to moderate adverse effects to accessibility for those seeking snowmobile experiences in the park, alternative 5 would result in parkwide, long-term beneficial impacts to accessibility when compared to the no-action alternative.

Cumulative Impacts

Impacts on visitor accessibility from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These and long-term beneficial impacts, when combined with the long-term beneficial impacts of alternative 5 would result in long-term beneficial cumulative impacts to visitor use and experience. Alternative 5 would make a large contribution to these impacts by supporting accessible winter visitor use and experience opportunities in the park, a unique recreational opportunity in the area.

Conclusion

Under alternative 5, changes in visitor experience created by the potential transition to snowcoach access only would result in parkwide, long-term beneficial impacts compared to the no-action alternative. For those seeking snowmobile experiences, impacts would be long-term, minor to moderate adverse. Cumulative impacts would be long-term and beneficial.

Impacts of Alternative 6: Implement Variable Management

Under alternative 6, winter access would be managed to increase the variety of winter experiences and also create flexibility in use levels. Primary park roads would be groomed for OSV access, including up to 78 snowcoaches per day, but the number of snowcoaches and snowmobiles would vary throughout the winter season. Accessible facilities in the park would continue to be available to support a comfortable and informative park experience for the very young, the elderly, and the mobility impaired. Entrance gate allocations would be flexible and incentives for use of new technology would be developed. Because visitor use in the park's interior would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities that support a safe and high-quality visitor experience would continue to be offered. As described for alternative 2, the park's accessible facilities would support an comfortable and educational experience. The existing fleet of snowcoaches is able to accommodate demand and would likely be able to meet the increased need for such services, as necessary. Those seeking snowmobile experiences would have access to this activity. Depending on snow conditions, availability of alternate routes, and service provider capacities, the very young, the elderly, and the mobility-impaired visitors could have increased flexibility in visiting the park during winter. The ability of operators to exchange permits would potentially provide accessibility based on demand. Alternative 6 would result in parkwide, long-term beneficial impacts for visitor accessibility.

Cumulative Impacts

Impacts on visitor accessibility from other past, present, and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term beneficial impacts of alternative 6 would result in long-term beneficial cumulative impacts to visitor use and experience. Alternative 6 would make a large contribution to these impacts by supporting accessible winter visitor use and experience opportunities in the park, a unique recreational opportunity in the area.

Conclusion

Under alternative 6, total snowcoach allocations would be similar to those in the 2009/2010 winter season. Flexibility in routes and gate entry numbers would potentially increase accessible snowcoach use. This would result in parkwide, long-term beneficial impacts to accessibility compared to the no-action alternative. Cumulative impacts would be long-term and beneficial.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Under alternative 7, winter access would be managed to provide varying use levels around the park and across the winter use season. Primary park roads would be groomed for OSV access, and snowcoach and snowmobile access would vary per day throughout the season. As described above, snowcoaches are suitable for wheelchair use or have ramps/lifts. Accessible facilities in the park would continue to support a comfortable and informative park experience for the very young, the elderly, and the mobility impaired. Snowmobile access would continue to be available for those seeking this experience. Because visitor use in the park's interior would continue, the Old Faithful Snow Lodge, warming huts, and other winter amenities supporting a safe and high-quality visitor experience would continue to be open. However, several existing OSV routes would be converted to non-motorized use, including the Firehole Canyon, North Canyon Rim, and Riverside Drive. As described for alternative 2, the park's accessible facilities would support a comfortable and educational experience those with accessibility needs. The existing fleet of snowcoaches would accommodate existing demand and would likely be able to meet the increased need for such services, as necessary. In addition, the ability of operators to exchange permits would potentially provide accessibility based on demand. Alternative 7 would provide long-term, parkwide, benefits to visitor accessibility.

Cumulative Impacts

Impacts on visitor accessibility from other past, present and reasonably foreseeable future actions would be as described for alternative 1. These long-term beneficial impacts, when combined with the long-term, parkwide, beneficial impacts of alternative 7 would result in long-term beneficial cumulative impacts to visitor accessibility. Alternative 7 would make a large contribution to these impacts by supporting accessible winter visitor use and experience opportunities in the park, a unique recreational opportunity in the area.

Conclusion

Under alternative 7, OSV allocations would vary within the winter use season, and would be expected to support current and future accessibility demands. This would result in parkwide, long-term beneficial impacts to accessibility compared to the no-action alternative. Cumulative impacts would be long-term and beneficial.

HEALTH AND SAFETY

GUIDING REGULATIONS AND POLICIES

NPS *Management Policies 2006* state, "While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service … will seek to provide a safe and healthful environment for visitors and employees." *Management Policies 2006* also state, "the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education" (NPS 2006a, section 8.2.5.1). For Yellowstone winter use, this would relate to the air and sound emissions, avalanche danger, and safety concerns between different modes of winter transportation (including conflicts between users and safety concerns related to motorized use in winter driving conditions) experienced by staff and visitors.

Air Emissions. The Occupational Safety and Health Administration (OSHA) sets enforceable permissible exposure limits (PELs) to protect workers against the health effects of exposure to hazardous substances. PELs are regulatory limits on the amount or concentration of a substance in the air, and are based on an 8-hour time weighted average exposure (OSHA 2006). Table 60 shows the PELs established by OSHA. In addition to these standards, studies at Yellowstone also consider the limits of the American Conference of Industrial Hygienists (ACGIH), which is an industry standard setting organization. ACGIH details threshold limit values (TLVs) for various air emissions, which are also presented in table 60.

TABLE 60: OSHA AND ACGIH LIMITS FOR AIR CONTAMINANTS

Substance	8-hour time weighted average – OSHA PEL	ACGIH Threshold Limit Value
Acetone	1000 ppm	500 ppm
Benzene	1.0 ppm	0.5 ppm
Carbon Monoxide	50 ppm	25 ppm
Ethyl Alcohol	1000 ppm	1000 ppm
Ethyl Benzene	100 ppm	100 ppm
Formaldehyde	0.75 ppm/2.0 ppm[a]	0.3 ppm[b]
Isopropyl Alcohol	400 ppm	400 ppm
Naphtha	100 ppm	—
Petroleum Distillates	500 ppm	—
Toluene	200 ppm	50 ppm
Xylene	100 ppm	100 ppm

[a]Short-term exposure limit
[b]Ceiling limits
Source: 29 CFR § 1910, Radtke 2008 and 2009
— Data not available

Noise Emissions. Various standards exist for occupational exposure to noise including the OSHA permissible exposure levels (PELs), EPA standards, and the National Institute for Occupational Safety and Health (NIOSH) standards, each discussed below.

In order to protect the hearing of employees, OSHA has established maximum noise levels for occupational exposure, beyond which mitigation measures or personal protective equipment is required. Table 61 shows the permissible noise exposures established by OSHA. The action level at which a hearing conservation program for employees is warranted, has been identified by OSHA as 85 dBA. The PEL for noise exposure as identified by OSHA is 90 dBA. The below analysis considers the 8-hour standard for all agencies, for purposes of comparison.

TABLE 61: OSHA PERMISSIBLE NOISE EXPOSURES

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

Source: OSHA 2006

Although primary responsibility for control of noise rests with state and local governments, federal action is essential to deal with major noise sources in commerce, control of which requires national uniformity of treatment (EPA 2010m). Directed by Congress, the EPA retains authority to investigate and study noise and its effects, disseminate information to the public regarding noise pollution and its adverse health effects, respond to inquiries on matters related to noise, and evaluate the effectiveness of existing regulations for protecting the public health and welfare, pursuant to the Noise Control Act of 1972 and the Quiet Communities Act of 1978 (EPA 2010n). Noise levels necessary to protect public health and welfare against hearing loss, annoyance, and activity interference have been identified and published in a new EPA document, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." The document identifies a 24-hour exposure level of 70 decibels as the level of environmental noise which will prevent any measurable hearing loss over a lifetime. Likewise, a level of 55 decibels outdoors is identified as preventing activity interference and annoyance (EPA 2010o).

In the Occupational Safety and Health Act of 1970, NIOSH is charged with recommending occupational safety and health standards, including noise exposure, and describing exposure concentrations that are safe for various periods of employment. By means of criteria documents, NIOSH communicates these recommended standards to regulatory agencies, including OSHA and others in the occupational health and safety community. In 1972, NIOSH published *Criteria for a Recommended Standard: Occupational Exposure to Noise*, which provided the basis for a recommended standard to reduce the risk of developing permanent hearing loss as a result of occupational noise exposure. NIOSH revised its previous recommendations in 1998, which go beyond attempting to conserve hearing by focusing on preventing occupational noise-induced hearing loss (NIOSH 1998). ANSI is a private, non-profit membership organization that serves as administrator and coordinator of the U.S. private sector voluntary standardization system. It facilitates the development of American National Standards by accrediting the procedures of organizations that develop standards. These groups work cooperatively to develop voluntary national consensus standards. ANSI empowers its members and constituents to strengthen the U.S. marketplace position in the global economy while helping to assure the safety and health of consumers and the protection of the environment (ANSI n.d.). The NIOSH and ANSI recommended exposure limit for occupational noise exposure is 85 decibels as an 8-hour time-weighted average (Noise Pollution Clearing House n.d.). With a 40-year lifetime exposure at the 85 decibel recommended exposure limit, the excess risk of developing occupational noise-induced hearing loss is eight percent, which is considerably lower than the 25% excess risk at the 90 decibel PEL currently enforced by OSHA (NIOSH 1998). Table 62 shows a comparison of noise exposure standards set by OSHA, EPA, NIOSH, and ANSI.

TABLE 62: COMPARISON OF NOISE EXPOSURE STANDARDS SET BY DIFFERENT ORGANIZATIONS

	EPA	ANSI and NIOSH	OSHA
dBA	Hours	Hours	Hours
70	24		
73	12		
76	6		
79	3		
82	1		
85		8	
88		4	
90			8
91		2	
92			6
94		1	
95			4
97			3
100			2
102			1

Source: Noise Pollution Clearinghouse n.d.

Avalanche Danger. On August 10, 11 and 12, 2010, seven internal NPS and external avalanche control experts and observers undertook a detailed, systematic review of agency winter operations on Sylvan Pass at Yellowstone, called an Operational Risk Management Assessment (ORMA). This review was a secondary follow-up to the initial ORMA conducted in 2007. The ORMA focused on the following four principles:

1. Accept no unnecessary risk.
2. Accept risk when benefits outweigh the cost.
3. Anticipate and manage risk by planning.
4. Make risk decisions at the right level.

A key feature is that ORMA does NOT tell you what to do, it gives you an accurate assessment of all risks and asks the question: “What is acceptable to you?” As part of the ORMA, the panel assessed possible operating conditions for Sylvan Pass, including current operations, and scored these various scenarios under the green-amber-red scale. The green-amber-red scale is shown in figure 24. For reference, current Sylvan Pass operations received a green-amber-red score of 34.67, or approximately 35, the high end of green.

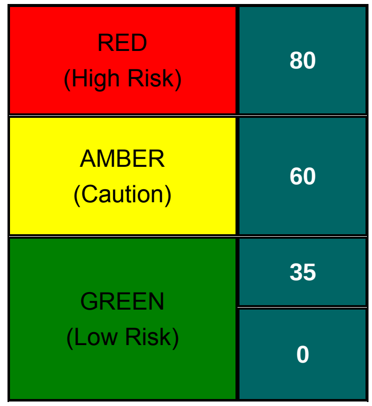


FIGURE 24: GREEN-AMBER-RED SCALE FOR THE ORMA PROCESS

Visitor Use Conflict/Exposure to the Elements. NPS *Management Policies 2006* address health and safety for both NPS staff and visitors. For NPS staff, section 1.9.1.4 "Employee Safety and Health" states,

> The safety and health of employees, contractors, volunteers, and the public are core Service values. In making decisions on matters concerning employee safety and health, NPS managers must exercise good judgment and discretion and, above all, keep in mind that the safeguarding of human life must not be compromised. The Service must ensure that all employees are trained and informed on how to do their jobs safely, and that they have the necessary clothing, materials, and equipment to perform their duties with minimal personal risk."

In relation to visitor safety, section 8.2.5.1, in part, states in part that

> While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service and its concessioners, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees. The Service will work cooperatively with other federal, tribal, state, and local agencies; organizations; and individuals to carry out this responsibility. The Service will strive to identify and prevent injuries from recognizable threats to the safety and health of persons and to the protection of property by applying nationally accepted codes, standards, engineering principles, and the guidance contained in Director's Orders #50B, #50C, #58, and #83 and their associated reference manuals. When practicable and consistent with congressionally designated purposes and mandates, the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education. In doing so, the Service's preferred actions will be those that have the least impact on park resources and values.
>
> The Service recognizes that the park resources it protects are not only visitor attractions, but that they may also be potentially hazardous. In addition, the recreational activities of some visitors may be of especially high-risk, high-adventure types, which pose a significant personal risk to participants and which the Service cannot totally control. Park visitors must assume a substantial degree of risk and responsibility for their own safety when visiting areas that are managed and maintained as natural, cultural, or recreational environments.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY DEFINITIONS

The area of analysis is the park. To assess the level of impact to employee and public health and safety for each alternative, the following types of information were used:

- Safety policies and guidelines.
- Results of air monitoring near the west entrance in Yellowstone.
- Results of personal exposure and sound monitoring.
- Reports from employees and commercial guides.
- Past and current avalanche analyses and the result of recent ORMA proceedings.

Overall impacts to health and safety, including impacts for avalanche control in the Sylvan Pass area of Yellowstone, are defined below. Because personal and occupational exposure to air quality and noise contaminants has been monitored in Yellowstone, the alternatives are compared qualitatively, using the monitored data (Jensen and Meyer 2006; Spear et al. 2006; Radtke 2008; Radtke 2009).

The following intensity definitions for evaluating impacts on health and safety were defined.

Negligible: Air and noise emissions would be well below applicable standards. There would be limited risk to employees conducting avalanche control activities during the winter use season at Sylvan Pass (green as defined by the ORMA). There would be no to minimal risks to visitors as a result of conflicts with other uses, as well as from the harsh winter elements.

Minor: Air and noise emissions would remain below applicable standards. If mitigation were needed, it would be relatively simple and would likely be successful. There would be limited to moderate risk to employees conducting avalanche control activities during the winter use season at Sylvan Pass (green as defined by ORMA). There could be occasional risks to visitors as a result of conflicts with other uses, as well as from the harsh winter elements, but reported incidents of these conflicts to law enforcement would remain infrequent.

Moderate: Applicable air and noise standards may be approached occasionally. Mitigation measures would probably be necessary and would likely be successful. There would be a moderate to high risk to employees conducting avalanche control activities during the winter use season at Sylvan Pass (amber as defined by ORMA). There could be occasional to frequent risks to visitors, reported to law enforcement, as a result of conflicts with other uses, as well as from the harsh winter elements.

Major: Applicable standards for air and noise would be exceeded rarely, and could be mitigated with simple measures. Extensive mitigation measures would be needed, and their success would not be guaranteed. There would be a high risk to employees conducting avalanche control activities during the winter use season at Sylvan Pass (red as defined by ORMA). There could be frequent risks to visitors, reported to law enforcement, as a result of conflicts with other uses, as well as from the harsh winter elements.

Study Area

The geographic study area for health and safety for the impact analysis and cumulative impact analysis is within the boundary of the park.

SUMMARY OF IMPACTS

Impacts to health and safety under the alternatives ranged from long-term moderate adverse, under alternatives 2, 3, 5, and 7 from potential use conflicts and the operation of Sylvan Pass, to long-term and beneficial for alternatives that include the closure of Sylvan Pass (alternatives 1 and 4). Impacts under each alternative were as follows:

- Alternative 1 would have long-term negligible adverse impacts to health and safety from noise and air emissions, because air pollution and noise levels would be limited to administrative OSV use and would be minimal. There would also be long-term beneficial impacts to health and safety from the closure of Sylvan Pass. Long-term minor adverse impacts would occur from the possibility of non-motorized users being out in harsh winter conditions with minimal support facilities.
- Alternatives 2, 3, 5, and 7 would have long-term negligible adverse impacts to health and safety from air and noise emissions, because levels would be well below all regulatory standards for human health. Because all of these alternatives would include the operation of Sylvan Pass, there would long-term moderate adverse impacts due to the inherent risk of staff working in a known avalanche zone. Use levels and types (both snowmobile and snowcoach use) under these alternatives would result in long-term minor to moderate adverse impacts from user conflicts and exposure to the elements. Impacts to health and safety would be similar to current conditions.
- Alternative 4 would have long-term negligible adverse impacts to health and safety from air and noise emissions because levels would be well below all regulatory standards for human health. The closure of Sylvan Pass would have long-term beneficial impacts because staff would not be working in a known avalanche zone. Because more users would be in commercial wheeled vehicles or snowcoaches, exposure to the elements would be reduced and long-term minor adverse impacts from user conflicts and exposure to the elements would occur.
- Alternative 6 would have long-term negligible adverse impacts to health and safety from air and noise emissions because levels would be well below all regulatory standards for human health. Because this alternative would include the operation of Sylvan Pass, there would long-term moderate adverse impacts due to the inherent risk of staff working in a known avalanche zone. Use levels would be higher than current conditions and would result in long-term minor to moderate adverse impacts from user conflicts and exposure to the elements.

DETAILED IMPACT ANALYSIS

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Under alternative 1, snowmobile use would be limited to administrative uses. The few administrative snowmobiles used in the park would meet BAT guidelines, with road grooming being completed on an as-needed basis (greatly reduced from current operations). Non-motorized uses would continue in the park, but would likely be limited to the outer edges due to the distance between the park entrance and Old Faithful, because many park visitors would not have the physical ability to cover this distance. Because no recreational or administrative OSV use would occur, Sylvan Pass would be closed to visitor use and would not require staff for daily avalanche control operations.

With this minimal level of use, exposure to air pollutants would be limited. As noted above under "Air Quality," emissions levels would be well below OSHA PELs and ACGIH TLVs when limited to administrative travel. Likewise, employees at the entrances would not be exposed to benzene or formaldehyde since recreational OSVs would no longer be going through the park entrances. As a result, there would be long-term negligible adverse impacts to health and safety in terms of air emissions.

Under the no-action alternative, noise would also be limited to administrative use. As described above under "Soundscapes and the Acoustic Environment," these noise levels would be minimal and well below OSHA, NIOSH, and EPA noise standards. As a result, there would be long-term negligible adverse impacts to health and safety in terms of sound emissions and there would be an improvement in air emissions over the current conditions.

With the closure of Sylvan Pass, avalanche control operations would not be necessary and park employees would not be exposed to the inherent risks of avalanche control operations (as described in chapter 3). During the 2010 ORMA, existing operations were considered, with the panel ranking them in the amber category. With the closure of Sylvan Pass, these operations would no longer be required, resulting in long-term beneficial impacts to staff health and safety, because they would no longer be forecasting in this area on a daily basis, reducing the amount of risk they would encounter. The 2010 ORMA also addressed the spring opening of Sylvan Pass in the context of winter avalanche management at Sylvan Pass, and additional challenges were identified for the spring opening of Sylvan Pass if avalanche forecasting and control operations did not occur in the winter.

Visitor use in the park would be limited to non-motorized use, the majority of which would occur on the periphery of the park. Non-motorized users may encounter administrative OSV use, but this use would be limited to a few trips a day and these encounters would be infrequent. In general, there would be long-term negligible adverse impacts, because the potential for conflict between uses would be minimal. However, non-motorized users could face increased risks in the interior of the park, because there would be limited facilities or other users to assist should weather conditions change, resulting in long-term minor adverse impacts. In addition, the limited staff that would be in the park during the winter season would not have back up should an emergency occur, because staffing within the park would be extremely limited.

Overall, air pollution and noise levels would be limited to administrative OSV use and would be minimal, and the closure of Sylvan Pass would reduce the avalanche risk to staff. Therefore, impacts would be long-term negligible adverse and long-term beneficial to health and safety, with the potential for long-term minor adverse impacts from the possibility of non-motorized users being out in harsh winter conditions with minimal support facilities.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that could impact health and safety include recreation occurring on adjacent lands (including use in consolidated forest lands). This recreation would require the use of vehicles or other equipment which create air and/or noise emissions in the region, but would not create any avalanche danger to be mitigated. All of these actions occur on lands outside of the park and do not extend into the park, except for OSV use, which is managed in the park to minimize impacts to health and safety and would result in long-term negligible adverse impacts.

Multiple construction projects currently occurring or planned in the park would also contribute to impacts on health and safety. These projects would include construction of the new west entrance and reconstruction of the east entrance road (underway). Overall, although construction sites could have temporary adverse impacts to park visitors related to health and safety, construction would not be occurring during the winter months and would not impact park staff and visitors during this time. Some of these projects would have beneficial impacts related to winter use because the reconstruction of the east entrance road has moved the road farther away from avalanche slide areas, and construction of new facilities at the west entrance has included new staff kiosks with improved ventilation systems, if needed. Overall, these construction projects would have long-term beneficial impacts to health and safety.

The long-term negligible adverse impacts and long-term beneficial impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible to minor adverse impacts and long-term beneficial impacts of alternative 1, would result in long-term negligible adverse cumulative impacts on health and safety. Alternative 1 would contribute a minimal amount to the overall cumulative impacts because many of these actions occur across a larger region of which Yellowstone is a part.

Conclusion

Overall, air pollution and noise levels would be limited to administrative OSV use and would be minimal, and the closure of Sylvan Pass would reduce the avalanche risk to staff. Therefore, impacts to health and safety would be long-term negligible adverse and long-term beneficial to health and safety, with the potential for long-term minor adverse impacts from the possibility of non-motorized users being out in harsh winter conditions with minimal support facilities. Cumulative impacts would be long-term, negligible adverse.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Under alternative 2, use levels in the park would allow for up to 318 snowmobiles per day and 78 snowcoaches, the level of use permitted under the 2009 interim rule. Existing OSV management measures that include BAT guidelines for snowmobiles, commercial guiding requirements, and hour of operation restrictions would continue. In addition to the current management measures employed, BAT guidelines would be developed and implemented for snowcoaches by the 2014/2015 season. Further, if the EPA adopts standards for any class of OSV that are more stringent than the requirements resulting from this draft plan/EIS, the EPA standards would become the NPS standards. Non-motorized uses would continue in the park, throughout the interior as currently occurring. Under alternative 2, Sylvan Pass would be open to visitor use and would require staff for daily avalanche control operations.

Staff exposure to air and noise emissions in the winter was measured during an exposure assessment conducted at the entrance stations during Presidents' Day weekend of 2008 (a peak use period). Use volume over the three-day weekend was 691 snowmobiles and 71 snowcoaches total (Radtke 2008). A similar exposure assessment was again conducted during President's Day weekend of 2009. During the 2009 assessment, use volumes were 635 snowmobiles and 64 snowcoaches total for the three-day weekend. In addition to a slightly lower level of use, the 2009 study differed from the 2008 study with a new entrance station configuration and during one day of the assessment (February 15), the emissions from snowcoaches were separated from snowmobiles to determine whether exposure levels would differ (Radtke 2009).

The 2008 and 2009 exposure assessments looked at air emissions through the measurement of carbon monoxide, hydrocarbons, and aldehydes. At these use levels, the exposure assessments found that results for all VOCs, aldehydes, and carbon monoxide were well below the occupational exposure limits (for OSHA and ACGIH) and in most cases were below the detection limits of the analytical method (Radtke 2008). In the 2008 assessment, results for VOCs showed that most were below the detection limit, with the relative highest exposure being to benzenes, which was approximately 2% of the PEL. Employees on snowmobiles did show measurable carbon monoxide exposures, but those levels were still below applicable standards (approximately 10% of the PEL). During this survey, three of nine aldehyde had detectable levels of formaldehyde (limit of detection was 1 ug/sample). Although detectable, these measurements were still only 2%-3% of the PEL and 5%-7% of the ACGIH TLV. No other aldehydes, such as acrolein or acetaldehyde were above the detection limit (Radtke 2008). In the 2009 assessment, similar results occurred with personal exposures to these contaminants well below OSHA PELs and ACGIH TLVs, with most being below detectable limits. In looking at the separation of snowcoaches and snowmobiles in 2009, these vehicles were separated by lane at the west entrance with 19 snowcoaches in lane B and 241 snowmobiles in lane A over the three-day weekend. Results of this separation showed that carbon monoxide was slightly higher over the sampling period for the snowmobile lane, but the peak reading was higher for snowcoaches (although the peak reading did not reach the NIOSH ceiling of 200 ppm). There was no difference evident in aldehydes or VOCs between the two vehicle types.

Results showing that air emissions were well within all applicable standards from the 2008 and 2009 assessments are due, in part, to the OSV management occurring in Yellowstone. Requirements for BAT, as well as required guides and limits on the number of OSVs in the park, contribute to keeping emissions well within regulatory levels. Also contributing to these low levels are the kiosk ventilation systems, where the employees work. Under alternative 2, use levels would be lower than those assessed in the 2008 and 2009 exposure assessments and management measures that have kept emissions low, described above, would be continued. With lower levels of use (up to 318 snowmobiles and 78 snowcoaches, compared to over 600 snowmobiles and a similar level of snowcoach use), it is expected that air emissions under alternative 2 would continue to be well below the detection limit and within OSHA PELs and ACGIH TLVs. As shown in the 2009 study, peak levels of carbon monoxide would likely be higher for snowmobiles than snowcoaches, but still within established levels. Because use would likely be within OSHA PELs and ACGIH TLVs with no exceedences, based on past monitoring, impacts on health and safety from air emissions would be long-term negligible adverse.

The 2008 and 2009 assessments looked at noise emissions at the west entrance as well as for employees using OSVs on a daily basis. In both 2008 and 2009, personal noise exposures in the two kiosks at the west entrance ranged from 67.1 dBA to 70.6 dBA. These levels are below the OSHA action level/PEL as well as EPA and NIOSH standards (Radtke 2008, 2009). The 2008 assessment also monitored a maintenance employee riding a four-stroke snowmobile for a full shift, and found that the full shift exposure was close to the OSHA action level (85 dBA) (Radtke 2008). Under alternative 2, use levels would be lower than those assessed in the 2008 and 2009 exposure assessments, and management measures that have kept noise emissions low, such as BAT and set use levels, would be continued. With lower levels of use, it is expected that noise emissions under alternative 2 would continue to be below the OSHA action level, and impacts on health and safety from noise emissions would be long-term negligible adverse.

Alternative 2 would provide for the continued operation of Sylvan Pass, with avalanche control operations continuing at their current levels. As described in the “Affected Environment” chapter, avalanche work is inherently dangerous and risks to employees may be greater than those generally posed to visitors because (1) employees conducting avalanche hazard mitigation spend more time in the pass, and (2) avalanche control work, by its very nature, is hazardous. Under alternative 2, the risk would be addressed through implementation of a strict safety-based, risk reduction program, continuing the program that is currently in place and was rated in a recent ORMA on the high end of green and the low end of amber (caution). The pass would not be open unless safety criteria are met and, in the professional judgment of park managers, operations can be conducted within acceptable levels of risk.

When park staff perform avalanche mitigation, a combination of avalanche mitigation techniques could be used, including risk assessment analyses as well as forecasting and helicopter and howitzer dispensed explosives. Area staff would use whichever tool is the safest and most appropriate for a given situation, with the full understanding that safety of employees and visitors comes first. Employees in the field would make the operational determination of when safety criteria have been met, and operations can be conducted with acceptable levels of risk. The NPS would not take unacceptable risks. When safety criteria have been met, the pass would be open; when they have not been met, the pass would remain closed. As with past winters, extended closures of the pass may occur. Also, during the winter season, the pass would not be open for administrative travel unless it is also open to public travel, further reducing employee exposure to risk. Because current operations were rated by the ORMA as green/amber (NPS 2010n), impacts to NPS staff from avalanche operations would be long-term moderate adverse.

Visitor use in the park would include both motorized and to non-motorized use. As noted in chapter 3 (figure 16), since OSV management that has included commercial guiding requirements was implemented, the number of OSV moving violations and arrests has continued to decline. Alternative 2 would continue OSV management measures put in place since 2004, including requiring commercially guided use of all OSVs. Guided use also ensures that guides have been trained (as part of their agreement with the NPS) in operation in winter conditions and in avoiding conflict with non-motorized users. The continuation of guiding requirements would have long-term beneficial impacts to health and safety. Alternative 2, as with all action alternatives, would not advise non-essential work/OSVs travel at below −20°F, which would reduce the amount of time both visitors and staff would spend in harsh winter conditions. Because OSV use would still occur, and staff and visitors would still be exposed to the winter elements, impacts would be long-term minor adverse, because OSV management and park practices would minimize both user conflict and risk from the elements.

Overall air pollution and noise levels would be below applicable standards, and conflicts between users and exposure to harsh winter conditions would be minimized through OSV management measures under alternative 2. NPS employees working in Sylvan Pass would still be exposed to avalanche risk, which has been rated at an amber (caution) level in a recent ORMA process (NPS 2010n). Under alternative 2, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements.

Cumulative Impacts

The long-term negligible adverse impacts and long-term beneficial impacts on the health and safety of NPS staff and visitors from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term negligible to moderate adverse impacts of alternative 2, would result in long-term minor adverse cumulative impacts on health and safety. Alternative 2 would contribute a minimal amount to the overall cumulative impacts because many of these actions occur across a larger region of which Yellowstone is a part.

Conclusion

Under alternative 2, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts under alternative 2 would be long-term minor adverse.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Under alternative 3, use levels in the park would allow for up to 720 snowmobiles per day and 78 snowcoaches, the level that was permitted under the 2004 plan limits. Existing OSV management measures would continue that include BAT guidelines for snowmobiles, commercial guiding requirements, and hour of operation restrictions would continue. In addition to the current management measures employed, BAT guidelines would be developed and implemented for snowcoaches by the 2014/2015 season. Further, if the EPA adopts standards for any class of OSV that are more stringent than the requirements resulting from this draft plan/EIS, the EPA standards would become the NPS standards. Non-motorized uses would continue in the park, throughout the interior as currently occurring. Under alternative 3, Sylvan Pass would be open to visitor use and would require staff for daily avalanche control operations.

As described above under alternative 2, exposure assessments were conducted over Presidents' Day weekend 2008 and 2009. These assessments found that at use levels between 635 and 691 snowmobiles and 64 and 71 snowcoaches (totals for the entire three-day weekend), exposures to air emissions were below all occupational exposure limits (Radtke 2008 and 2009). In addition, a study conducted by OSHA in 2000 considered 976 two-stroke snowmobiles(a daily average) and showed levels below applicable standards in two out of three entry kiosks. At the third, the exposure level was at the OSHA threshold (OSHA 2000). In 2001, benzene levels from a daily average of 666 two-stroke sleds were considered and found to be below all applicable standards at all three kiosks (Kado et al. 2001). Studies done in 2004, 2005, and 2006 also looked at benzene levels, with mostly four-stroke engines, with levels greatly decreasing from the 2000 and 2001 levels. Based on these data, it can be assumed that the use level proposed under alternative 3 (720 four-stroke sleds) would result in benzene levels that are below regulatory standards because at a daily average of 976 two-stroke sleds, the standards were just being met and with four-stroke engines, this would be expected to fall below the regulated level.

As with alternative 2, requirements for BAT, as well as required guides and limits on the number of OSVs in the park, would contribute to keeping emissions well within regulatory levels as shown in the studies noted above. Also contributing to these low levels are the kiosk ventilation systems, where the employees work. Under alternative 3, use levels would be higher than those assessed in the 2008 and 2009 exposure assessments but lower than those assessed in the 2000 OSHA study. Management measures employed since 2004 (BAT, guided use, and use limits) have kept emissions within the regulatory standards described above, and would be continued under alternative 3. Based on this, it is expected that air emissions under alternative 3 would continue to be below the detection limit and within OSHA PELs and ACGIH TLVs. As shown in the 2009 study, peak levels of carbon monoxide would likely be higher for snowmobiles than snowcoaches, but still within established levels. Because use would likely be within OSHA PELs and ACGIH TLVs with no exceedences, based on past monitoring, impacts on health and safety from air emissions would be long-term negligible adverse.

The 2008 and 2009 assessments also looked at noise emissions at the west entrance as well as for employees using OSVs on a daily basis. As described in alternative 2, personal noise exposures in the two kiosks at the west entrance were below the OSHA action level/PEL as well as EPA and NIOSH standards (Radtke 2008, 2009). As described under "Soundscapes and the Acoustic Environment," a use level of up to 720 snowmobiles and 78 snowcoaches would result in noise levels of over 35 dBA approximately 15% of the time. Although use levels would be higher under alternative 3 than the levels studied in 2008 and 2009, these levels do not have the potential to be much higher (a high of

691 snowmobiles vs. a potential high of 720 snowmobiles) and noise levels would still be expected to be below the OSHA action level. Under alternative 3, use levels would be similar to those in the 2008 and 2009 exposure assessments and management measures that have kept noise emissions below the standards, such as BAT and set use levels, would be continued. With similar levels of use, it is expected that noise emissions under alternative 3 would continue to be below the OSHA action level and impacts on health and safety from noise emissions would be long-term negligible adverse.

Alternative 3 would provide for the continued operation of Sylvan Pass, with avalanche control operations continuing at their current levels, as described in detail under alternative 2. These operations were rated by the recent ORMA as amber, or caution, in terms of the risk to NPS staff (NPS 2010n), therefore impacts to NPS staff from avalanche operations would be long-term moderate adverse.

Visitor use in the park would include both motorized and to non-motorized use. As noted in chapter 3 (figure 16), since OSV management that includes commercial guiding requirements has been implemented, the number of OSV moving violations and arrests has continued to decline. Alternative 3 would continue OSV management measures put in place since 2004 including requiring guided use of all OSV. Commercially guided use also ensures that guides have been trained (as part of their agreement with the NPS) in operation in winter conditions and in avoiding conflict with non-motorized users. The continuation of guiding requirements would have long-term beneficial impacts to health and safety. Alternative 3, as with all action alternatives, would not advise non-essential work/OSVs travel at below −20°F, which would reduce the amount of time both visitors and staff would spend in harsh winter conditions. Because OSV use would still occur, and staff and visitors would still be exposed to the winter elements, impacts would be long-term minor adverse, because OSV management and park practices would minimize both user conflict and risk from the elements.

Overall air pollution and noise levels are expected to be below applicable standards and conflicts between users and exposure to harsh winter conditions would be minimized through OSV management measures under alternative 3. NPS employees working in Sylvan Pass would still be exposed to avalanche risk, which has been rated at an amber (caution) level in a recent ORMA process (NPS 2010n). Under alternative 3, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements.

Cumulative Impacts

The long-term negligible adverse impacts and long-term beneficial impacts on the health and safety of NPS staff and visitors from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term negligible to moderate adverse impacts of alternative 3, would result in long-term minor adverse cumulative impacts on health and safety. Alternative 3 would contribute a minimal amount to the overall cumulative impacts, because many of these actions occur across a larger region, of which Yellowstone is a part.

Conclusion

Under alternative 3, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Under alternative 4, use levels in the park would allow for up to 110 snowmobiles per day and 30 snowcoaches per day, along with up to 100 wheeled commercial vehicles. Existing regulations on OSV use would continue that include BAT guidelines for snowmobiles, commercial guiding requirements, and hour of operation restrictions would continue. In addition to the current management measures employed, BAT guidelines would be developed and implemented for snowcoaches by the 2014/2015 season. Further, if the EPA adopts standards for any class of OSV that are more stringent than the requirements resulting from this draft plan/EIS, the EPA standards would become the NPS standards. For wheeled vehicles, EPA tier II guidelines would be followed, providing emissions reduction. Non-motorized uses would continue in the park, throughout the interior as currently occurring. Under alternative 4, Sylvan Pass would not be open to visitor use and would not require staff for daily avalanche control operations.

As described above under alternative 2, exposure assessments were conducted over Presidents' Day weekend 2008 and 2009. These assessments found that at use levels between 635 and 691 snowmobiles and 64 and 71 snowcoaches over a three-day weekend, exposures to air emissions were below all occupational exposure limits (Radtke 2008, 2009). Because use levels for OSVs would be lower (1/6 less than the measured use), it is expected that air emissions exposure from OSVs for alternative 4 would continue to be below all occupational exposure limits. The addition of commercial wheeled vehicles would occur under this alternative; however, by meeting tier II standards, their contribution to these pollutants would not be expected to result in a violation of exposure limits. As shown in the 2009 study, peak levels of carbon monoxide would likely be higher for snowmobiles than snowcoaches, but still within established levels. Because use would likely be within OSHA PELs and ACGIH TLVs with no exceedences, based on past monitoring, impacts from air emissions on health and safety would be long-term negligible adverse.

The 2008 and 2009 assessments also looked at noise emissions at the west entrance as well as for employees using OSVs on a daily basis. As described in alternative 2, personal noise exposures in the two kiosks at the west entrance were below the OSHA action level/PEL as well as EPA and NIOSH standards (Radtke 2008, 2009). With lower levels of use proposed than those assessed in 2008 and 2009, it is expected that noise emissions under alternative 4 would continue to be below the OSHA action level and impacts on health and safety from noise emissions would be long-term negligible adverse.

With the closure of Sylvan Pass under alternative 4, avalanche control operations would not be necessary and park employees would not be exposed to the inherent risks of avalanche control operations (as described in chapter 3). During the 2010 ORMA, existing operations were considered, with the panel ranking them in the amber category, or caution (NPS 2010n). With the closure of Sylvan Pass, these operations would no longer be required, resulting in long-term beneficial impacts to staff health and safety, because they would no longer be forecasting in this area on a daily basis reducing the amount of risk they encounter. The 2010 ORMA also addressed the spring opening of Sylvan Pass in the context of winter avalanche management at Sylvan Pass, and additional challenges were identified for the spring opening at Sylvan Pass if avalanche forecasting and control operations did not occur in the winter.

Visitor use in the park would include both motorized and to non-motorized use. As noted in chapter 3 (figure 16), as commercial guiding requirements were implemented, the number of OSV moving violations and arrests has continued to decline. Alternative 4 would continue OSV management measures put in place since 2004 including requiring commercially guided use of all OSV and in addition would require wheeled vehicles to be commercially guided (with the exception of the northern park road, which would still permit private vehicles). Commercially guided use also ensures that guides have been trained (as part of their agreement with the NPS) in operation in winter conditions and in avoiding conflict with non-motorized users. The use of commercial guides for wheeled vehicles within the park is also expected to contribute to visitor safety because guides would be trained to handle fast changing weather conditions, have communication equipment to report any problems, and would be required to carry safety equipment on board, resulting in long-term beneficial impacts. Alternative 4, as with all action alternatives, would not advise non-essential work/OSVs travel at below −20°F, which would reduce the amount of time both visitors and staff would spend in harsh winter conditions. Because OSV use would still occur, and staff and visitors would still be exposed to the winter elements, impacts would be long-term minor adverse, because OSV management and park practices would minimize both user conflict and risk from the elements.

Overall air pollution and noise levels would be expected to be below applicable standards and conflicts between users and exposure to harsh winter conditions would be minimized through OSV management measures under alternative 4. NPS employees working in Sylvan Pass would not be exposed to avalanche risk because Sylvan Pass would be closed. Under alternative 4, impacts to human health and safety would be long-term negligible adverse from air and noise emissions as well as long-term beneficial from the closure of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements.

Cumulative Impacts

The long-term negligible adverse and long-term beneficial impacts on the health and safety of NPS staff and visitors from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term negligible to minor adverse and long-term beneficial impacts of alternative 4, would result in long-term negligible adverse cumulative impacts on health and safety. Alternative 4 would contribute a minimal amount to the overall cumulative impacts because many of these actions occur across a larger region of which Yellowstone is a part.

Conclusion

Under alternative 4, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term beneficial from the closure of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term negligible adverse.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Under alternative 5, until 2014/2015 when the transition to BAT snowcoaches only would begin, use levels and their impacts to health and safety would be the same as under alternative 2, long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass and long-term minor adverse from user conflicts and exposure to the elements.

After the 2014/2015 season, OSV use would potentially transition to snowcoach only after five years, based on user demand or at the Superintendent’s discretion, and could result in use levels at 120 snowcoaches and zero snowmobiles at the end of the transition. Existing regulations on OSV use would continue that include BAT guidelines for snowmobiles, commercial guiding requirements, and hour of operations restrictions. In addition to the current management measures employed, BAT guidelines would be developed and implemented for snowcoaches by the 2014/2015 season. Further, if the EPA adopts standards for any class of OSV that are more stringent than the requirements resulting from this draft plan/EIS, the EPA standards would become the NPS standards. Non-motorized uses would continue within the park, throughout the interior as currently occurring. Under alternative 5, Sylvan Pass would be open to visitor use and would require staff for daily avalanche control operations.

As described above under alternative 2, exposure assessments were conducted over Presidents' Day weekend 2008 and 2009. These assessments found that at use levels between 635 and 691 snowmobiles and 64 and 71 snowcoaches over a three-day weekend, exposures to air emissions were below all occupational exposure limits (Radtke 2008 and 2009). Because use levels for OSV would be lower (approximately one-sixth of less than the measured use), it is expected that air emissions exposure from OSV for alternative 5 would continue to be below all occupational exposure limits. As shown in the 2009 study, peak levels of carbon monoxide were higher for snowmobiles than snowcoaches, but still within established levels. As the number of snowcoaches permitted increases above the levels studied, additional exposure assessments would occur to ensure emission levels stay below occupational exposure limits. However, since the additional 42 snowcoaches would be offset by a reduction of 318 snowmobiles, it is expected that these limits would be not be exceeded. Because use would likely be within OSHA PELs and ACGIH TLVs with no exceedences, based on past monitoring, impacts on health and safety from air emissions would be long-term negligible adverse.

The 2008 and 2009 assessments also looked at noise emissions at the west entrance as well as for employees using OSV on a daily basis. As described in alternative 2, personal noise exposures within the two kiosks at the west entrance were below the OSHA action level/PEL as well as EPA and NIOSH (Radtke 2008, 2009). With lower levels of total OSV use proposed after the transition to snowcoaches only than assessed in 2008 and 2009, it is expected that noise emissions under alternative 5 would continue to be below the OSHA action level and impacts on health and safety from noise emissions would be long-term negligible adverse.

Alternative 5 would provide for the continued operation of Sylvan Pass, with avalanche control operations continuing at their current levels, as described in detail under alternative 2. These operations were rated by the recent ORMA as amber, or caution in terms of the risk to NPS staff (NPS 2010n), therefore impacts to NPS staff from avalanche operations would be long-term moderate adverse.

Visitor use in the park would include both motorized and to non-motorized use. As noted in chapter 3 (figure 16), as commercial guiding requirements were implemented, the number of OSV moving violations and arrests has continued to decline. Alternative 5 would continue OSV management measures put in place since 2004, including requiring commercially guided use of all OSVs and after the transition would potentially include snowcoaches only. Commercially guided use also ensures that guides have been trained (as part of their agreement with the NPS) in operation in winter conditions and in avoiding conflict with non-motorized users. The continuation of commercial guiding requirements would have long-term beneficial impacts to health and safety. Alternative 5, as with all action alternatives, would not advise non-essential work/OSVs travel at below −20°F, which would reduce the amount of time both visitors and staff would spend in harsh winter conditions. Because OSV use would still occur, and staff and visitors would still be exposed to the winter elements, impacts would be long-term minor adverse, because OSV management and park practices would minimize both user conflict and risk from the elements.

Overall, air pollution and noise levels would be expected to be below applicable standards, and conflicts between users and exposure to harsh winter conditions would be minimized through OSV management measures under alternative 5. NPS employees working in Sylvan Pass would still be exposed to avalanche risk, which has been rated at an amber (caution) level in a recent ORMA process (NPS 2010n). Under alternative 5, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass and long-term minor adverse from user conflicts and exposure to the elements.

Cumulative Impacts

The long-term negligible adverse impacts and long-term beneficial impacts on the health and safety of NPS staff and visitors from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term negligible to moderate adverse impacts of alternative 5, would result in long-term minor adverse cumulative impacts on health and safety. Alternative 5 would contribute a minimal amount to the overall cumulative impacts because many of these actions occur across a larger region of which Yellowstone is a part.

Conclusion

Under alternative 5, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor adverse from user conflicts and exposure to the elements, both before and after the transition to snowcoach only. Cumulative impacts would be long-term minor adverse.

Impacts of Alternative 6: Implement Variable Management

Under alternative 6, there would be a seasonal limit of 32,000 snowmobiles and 4,600 snowcoaches. The level of daily use would vary throughout the season, based on a pre-determined schedule; however, daily use would not exceed 540 snowmobiles and 78 snowcoaches. Existing regulations on OSV use would continue that include BAT guidelines for snowmobiles, commercial guiding requirements, and hour of operations restrictions would continue. In addition to the current management measures employed, BAT guidelines would be developed and implemented for snowcoaches by the 2014/2015 season. Further, if the EPA adopts standards for any class of OSV that are more stringent than the requirements resulting from this draft plan/EIS, the EPA standards would become the NPS standards. Alternative 6 would also provide for up to 25% of snowmobile use to be unguided or non-commercially guided. This additional requirement would bring a level of uncertainty with regard to health and safety as, without commercial guides, the NPS would not have assurance that all applicable rules put in place to reduce risk, such as speed limits and protocols for passing groups, would be followed, and would result in long-term minor adverse impacts. Non-motorized uses would continue in the park, throughout the interior as currently occurring. Under alternative 6, Sylvan Pass would be open to visitor use and would require staff for daily avalanche control operations.

As described above under alternative 2, exposure assessments were conducted over Presidents' Day weekend 2008 and 2009. These assessments found that at use levels between 635 and 691 snowmobiles and 64 and 71 snowcoaches over a three-day weekend, exposures to air emissions were below all occupational exposure limits (Radtke 2008, 2009). Although OSV numbers would range from zero to 540 under alternative 6, they would still be lower than measured in 2008 and 2009; therefore, it is expected that air emissions exposure from OSVs for alternative 6 would continue to be below all occupational exposure limits. As shown in the 2009 study, peak levels of carbon monoxide were higher for snowmobiles than snowcoaches, but still within established levels, and this would be expected to continue. Because use would likely be within OSHA PELs and ACGIH TLVs with no exceedences, based on past monitoring, impacts on health and safety from air emissions would be long-term negligible adverse.

The 2008 and 2009 assessments also looked at noise emissions at the west entrance as well as for employees using OSVs on a daily basis. As described in alternative 2, personal noise exposures in the two kiosks at the west entrance were below the OSHA action level/PEL as well as EPA and NIOSH standards (Radtke 2008, 2009). With lower levels of total OSV use proposed (even on peak days of up to 540 snowmobiles and 78 snowcoaches) than those assessed in 2008 and 2009, it is expected that noise emissions under alternative 6 would continue to be below the OSHA action level and impacts on health and safety from noise emissions would be long-term negligible adverse.

Alternative 6 would provide for the continued operation of Sylvan Pass, with avalanche control operations continuing at their current levels, as described in detail under alternative 2. These operations were rated by the recent ORMA as amber, or caution in terms of the risk to NPS staff (NPS 2010n); therefore, impacts to NPS staff from avalanche operations would be long-term moderate adverse.

Visitor use in the park would include both motorized and to non-motorized use. As noted in chapter 3 (figure 16), as requirements for commercial guiding were implemented, the number of OSV moving violations and arrests has continued to decline. Alternative 6 would continue OSV management measures put in place since 2004, including requiring commercially guided use of most OSVs. In addition, alternative 6 would allow for up to 25% of unguided or non-commercially guided use. Commercially guided use also ensures that guides have been trained (as part of their agreement with the NPS) in operation in winter conditions and in avoiding conflict with non-motorized users. Although those engaging in unguided or non-commercially guided use would receive training, these users would not receive the same level of education and instruction as a commercial guide, which could result in additional conflicts between users. Alternative 6, as with all action alternatives, would not advise non-essential work/OSVs travel at below −20°F, which would reduce the amount of time both visitors and staff would spend in harsh winter conditions. Because OSV use would still occur and the addition of unguided or non-commercially guided use could increase non-compliance with OSV management measures, and staff and visitors would still be exposed to the winter elements, impacts would be long-term minor to moderate adverse, because OSV management and park practices would minimize both user conflict and risk from the elements.

Overall air pollution and noise levels would be expected to be below applicable standards and conflicts between users and exposure to harsh winter conditions would be minimized through OSV management measures under alternative 6. Alternative 6 would have the potential for increased non-compliance with OSV management measures due to up to 25% of unguided or non-commercially guided use and could increase visitor use conflicts. NPS employees working in Sylvan Pass would still be exposed to avalanche risk, which has been rated at an amber (caution) level in a recent ORMA process (NPS 2010n). Under alternative 6, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass and long-term minor to moderate adverse from user conflicts and exposure to the elements.

Cumulative Impacts

The long-term negligible adverse impacts and long-term beneficial impacts on the health and safety of NPS staff and visitors from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term negligible to moderate adverse impacts of alternative 6, would result in long-term minor adverse cumulative impacts on health and safety. Alternative 6 would contribute a minimal amount to the overall cumulative impacts because many of these actions occur across a larger region of which Yellowstone is a part.

Conclusion

Under alternative 6, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass, and long-term minor to moderate adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Under alternative 7, daily use levels would vary throughout the season, based on a pre-determined schedule. For snowmobiles, an average of 254 snowmobiles would operate in the park per day for a total of 23,122 per season should the maximum capacity be reached each day throughout the winter season. For snowcoaches, an average of 63 snowcoaches would operate in the park per day for a total of 5,730 per season should the maximum capacity be reached each day throughout the winter season. Actual use days may be higher or lower than this average ranging from a low of 132 snowmobiles and 30 snowcoaches to a high of 330 snowmobiles per day and 80 snowcoaches per day. All OSVs would be required to enter the park by 10:30 a.m. under alternative 7.

As with alternative 6, existing regulations on OSV use would continue that include BAT guidelines for snowmobiles and snowcoaches, commercial guiding requirements, and hour of operation restrictions would continue. Additional BAT restriction would include development of BAT for NO_x. Further, if the EPA adopts standards for any class of OSV that are more stringent than the requirements resulting from this draft plan/EIS, the EPA standards would become the NPS standards. Non-motorized uses would continue in the park, throughout the interior as currently occurring. Under alternative 7, Sylvan Pass would be open to visitor use and would require staff for daily avalanche control operations.

As described above under alternative 2, exposure assessments were conducted over Presidents' Day weekend 2008 and 2009. These assessments found that at use levels between 635 and 691 snowmobiles and 64 and 71 snowcoaches over a three-day weekend, exposures to air emissions were below all occupational exposure limits (Radtke 2008, 2009). Although numbers of OSVs would range from zero to 330 under alternative 7, they would still be lower than those measured in 2008 and 2009; therefore, it is expected that air emissions exposure from OSVs under alternative 7 would continue to be below all occupational exposure limits. As shown in the 2009 study, peak levels of carbon monoxide were higher for snowmobiles than snowcoaches, but still within established levels, and this would be expected to continue. Because use would likely be within OSHA PELs and ACGIH TLVs with no exceedences, based on past monitoring, impacts on health and safety from air emissions would be long-term negligible adverse.

The 2008 and 2009 assessments also looked at noise emissions at the west entrance as well as for employees using OSV on a daily basis. As described in alternative 2, personal noise exposures in the two kiosks at the west entrance were below the OSHA action level/PEL as well as EPA and NIOSH standards (Radtke 2008, 2009). With similar or slightly higher numbers of total OSV use proposed (even on peak days of 330 snowmobiles and 80 snowcoaches) than those assessed in 2008 and 2009, it is expected that noise emissions under alternative 7 would continue to be below the OSHA action level and impacts on health and safety from noise emissions would be long-term negligible adverse.

Alternative 7 would provide for the continued operation of Sylvan Pass, with avalanche control operations continuing at their current levels, as described in detail under alternative 2. These operations were rated by the recent ORMA as amber, or caution in terms of the risk to NPS staff (NPS

2010n), therefore impacts on NPS staff from avalanche operations would be long-term moderate adverse.

Visitor use in the park would include both motorized and to non-motorized use. As noted in chapter 3 (figure 16), as commercial guiding requirements were implemented, the number of OSV moving violations and arrests has continued to decline. Alternative 7 would continue OSV management measures put in place since 2004 including requiring guided use of OSVs. Commercial guided use also ensures that guides have been trained (as part of their agreement with the NPS) in operation in winter conditions and in avoiding conflict with non-motorized users. The continuation of commercial guiding requirements would have long-term beneficial impacts on health and safety. Alternative 7, as with all action alternatives, would not advise non-essential work/OSVs travel at below −20°F, which would reduce the amount of time both visitors and staff would spend in harsh winter conditions. Because OSV use would still occur and staff and visitors would still be exposed to the winter elements, impacts would be long-term minor adverse, because OSV management and park practices would minimize both user conflict and risk from the elements.

Overall air pollution and noise levels would be expected to be below applicable standards and conflicts between users and exposure to harsh winter conditions would be minimized through OSV management measures under alternative 7. NPS employees working in Sylvan Pass would still be exposed to avalanche risk, which has been rated at an amber (caution) level in a recent ORMA process (NPS 2010n). Under alternative 7, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass and long-term minor adverse from user conflicts and exposure to the elements.

Cumulative Impacts

The long-term negligible adverse impacts and long-term beneficial impacts on the health and safety of NPS staff and visitors from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The effects of these actions, when combined with the long-term negligible to moderate adverse impacts of alternative 7, would result in long-term minor adverse cumulative impacts on health and safety. Alternative 7 would contribute a minimal amount to the overall cumulative impacts because many of these actions occur across a larger region, of which Yellowstone is a part.

Conclusion

Under alternative 7, impacts to human health and safety would be long-term negligible adverse from air and noise emissions, long-term moderate adverse from the operation of Sylvan Pass and long-term minor adverse from user conflicts and exposure to the elements. Cumulative impacts would be long-term minor adverse.

SOCIOECONOMIC VALUES

GUIDING REGULATIONS AND POLICIES

Economic and social values are fully entwined through the regulatory and policy environment of the NPS. The NPS Director's Order 12 Handbook (NPS 2001) requires analysis of economic and social impacts as part of the NEPA process. The document specifies that economic and social analysis includes "employment, occupation, income changes, tax base, infrastructure" (Appendix 1, NPS 2001). Indirect effects on concessioners and other businesses that may be affected by the alternatives must be considered.

ASSUMPTIONS, METHODOLOGY, AND IMPACT DEFINITIONS

This section analyzes how winter use management alternatives would likely impact recreational use in the greater Yellowstone area and how change in recreational use would impact economic activity (expenditures and employment) within the area.

Impact results are presented at three different levels: the three-state area (Idaho, Montana, and Wyoming), the five-county area (Fremont County in Idaho, Gallatin and Park counties in Montana, and Park and Teton counties in Wyoming), and at the community level (Cody and Jackson, Wyoming, and West Yellowstone, Montana). Past reports including Duffield and Neher (2006 and 2007) and the 2008 environmental assessment prepared by NPS (NPS 2008a) present a host of results on the economic impacts of different alternatives, along with the data on recreational use and visitor expenditure levels used in the analysis. The current analysis draws on these past reports, updating the results with more recent economic data.

The impact analysis uses the upper and lower bounds on visitation estimated for previous reports (Duffield and Neher 2006; NPS 2008a) to analyze the impacts of the current set of action alternatives relative to the no-action alternative, except alternative 7. Alternative 7 does not match previous alternatives and the assumptions used to create the bounds on visitation are described below. The impacts were estimated using the most recent version of IMPLAN (Minnesota IMPLAN Group, 2008). The analysis looks at impacts for the three state area (Idaho, Montana, and Wyoming) the five county area (Fremont County in Idaho, Gallatin and Park counties in Montana, and Park and Teton counties in Wyoming), Cody and Jackson, Wyoming, and West Yellowstone, Montana. The community regions are approximated using zip code boundaries.

Table 63 compares the current alternatives to the alternatives from previous reports that were used to derive assumptions about visitation change. Current alternatives 1, 2, and 3 are identical to alternatives considered in past reports. Alternatives 4, 5, 6, and 7 differ from the alternatives in the previous reports. Alternative 4 would set lower limits on snowmobile use compared to similar alternatives in the 2007 EIS and Duffield and Neher (2006). Alternative 5 would have a period of five years over which snowmobile use would be phased out, which is not included in the similar alternatives in the 2007 EIS and Duffield and Neher (2006). Alternative 6 would set daily limits, whereas the similar alternative from 2007 EIS and Duffield and Neher (2006) would allow for extra snowmobiles to enter on crowded days, but the snowmobiles count against a seasonal total. Alternative 6 has a higher seasonal total for snowmobiles, a lower seasonal total for snowcoaches, and it allows a higher percent of unguided snowmobiles than the similar alternative from the earlier reports. Alternative 7 includes variable use levels, like alternative 6, but with use levels closer to alternative 2.

TABLE 63: SUMMARY OF ALTERNATIVES FOR SOCIOECONOMICS

Alternative	Description of Alternative	Comparable Alternatives from Previous Reports	Differences with Previous Reports
Alternative 1 (no-action alternative)	Once the 2009 interim rule expired (after the 2010/2011 season) there would be no rule in place and OSV use would not be permitted. Administrative OSV use would continue as needed. Visitors could ski or snowshoe into the park.	1. Duffield and Neher 2006: Motorized Ban Baseline 2. 2007 EIS: Alternative 3B (Recreational OSV access would cease in all the park) 3. 2008 EA: Alternative 1 (No recreational snowmobile or snowcoach use would be allowed in the park)	No difference
Alternative 2	OSV use would continue at levels described under the 2009 interim rule – up to 318 snowmobiles and up to 78 snowcoaches per day.	1. 2008 EA: Alternative 2 would allow up to 318 snowmobiles and 78 snowcoaches in Yellowstone	No difference
Alternative 3	OSV levels in the park would return to the 2004 plan limits – up to 720 snowmobiles and 78 snowcoaches per day.	1. Duffield and Neher, 2006: Temporary Rules Baseline 2. 2007 EIS: Alternative 1	No difference
Alternative 4	Access to the park would be by commercial wheeled vehicles (north and west entrances) and snowmobiles and snowcoach (south entrance) only. The east entrance would be closed to through travel for OSVs, but open for non-motorized use. Up to 110 snowmobiles per day, 30 snowcoaches per day	1. 2007 EIS: Alternative 6 (Wheeled commercial vehicle access, OSV access through the south entrance and on the east side of the park, 350 snowmobiles per day (250 south entrance, 100 Old Faithful), 40 snowcoaches per day, 100 commercial wheeled vehicles) 2. Duffield and Neher 2006: Alternative 6	2007 EIS and Duffield and Neher 2006 allow an additional 240 snowmobiles per day and 10 additional snowcoaches per day compared to the current alternative 4. Visitation would be lower under the current alternative 4.
Alternative 5	OSV access to the park would be via BAT snowcoach only. This would be accomplished by phasing out snowmobiles beginning in the 2014/2015 season, when all snowcoaches would be required to have BAT. Snowcoaches would replace snowmobiles within a five-year period (depending on coach user demand). Up to 318 snowmobiles per day through 2014/2015 winter season. Up to 78 snowcoaches per day initially, allocated by entrance the same as in alternative 2. As of 2014/1015, increase to 120 BAT snowcoaches per day, (with a corresponding decrease in snowmobiles over a five-year period as snowcoach numbers increase).	1. 2007 EIS: Alternative 2 (Emphasizes snowcoach access; prohibits recreational snowmobiling. Road grooming would continue. Sylvan Pass would be closed to through travel. 120 snowcoaches per day) 2. Duffield and Neher 2006: Alternative 2	2007 EIS and Duffield and Neher 2006 do not have a period during which snowmobiles would phase out. Visitation would be higher under the current alternative 5 because of the phase out period that could last 9 years.

Alternative	Description of Alternative	Comparable Alternatives from Previous Reports	Differences with Previous Reports
Alternative 6	OSV levels would vary by creating times and places for higher and lower levels of use. 32,000 snowmobiles would be permitted each season. Daily numbers could vary between 0 and 540. Mostly guided, with up to 25% of snowmobile use unguided or non-commercially guided. 4,600 snowcoaches would be permitted per season	1. 2007 EIS: Alternative 5 (Features a seasonal limit as well as a flexible daily limit. Sylvan Pass would be open to through travel. Up to 540 snowmobiles per day, 80% commercially guided 20% unguided or non-commercially guided, 83 snowcoaches per day.) The seasonal limit would be 27,540 for snowmobiles. 5,291 snowcoaches would be allowed per season. 2. Duffield and Neher 2006: Alternative 5	Alternative 6 sets daily limits, whereas alternative 5 from the 2007 EIS allows for additional snowmobiles on crowded days that count against a seasonal total. Alternative 6 has a higher seasonal total for snowmobiles and a lower seasonal total for snowcoaches than alternative 5. Alternative 6 allows for more unguided snowmobiles, as well.
Alternative 7	Three different daily limits for OSV levels would are set to provides days with higher and lower use. During the season the limit on snowmobiles would be 330 for 45 days, 220 for 30 days, and 132 for 16 days. This yields a maximum of 23,562 per season. All snowmobiles would be part of commercially guided tours. Three daily limits are used for snowcoaches, as well. Daily limits are 80 snowcoaches for 45 days during the season, 50 snowcoaches for 30 days and 30 snowcoaches for 16 days. The maximum number of snowcoaches would be 5,730 per season.	No similar alternative.	No similar alternative.

IMPLAN Modeling

As in the previous reports, the socioeconomic analysis relies on IMPLAN modeling. The 2008 EA (NPS 2008a) describes IMPLAN as follows: IMPLAN is an “input/output” economic model designed by the USFS and is commonly used by state and federal agencies for planning and evaluation purposes. For example, Dean Runyan and Associates (2006) used IMPLAN modeling in a report to the State of Wyoming on the economic impact of travel in Wyoming. Among other outputs, IMPLAN generates estimates of output and employment. Output is the total business revenue generated by a given activity such as park visitation, and employment is the resulting number of jobs (all jobs – full and part time) associated with that activity.

There are four important caveats that are relevant to the interpretation of the IMPLAN model estimates generated for this analysis. First, the model is static in nature and measures only those effects resulting from a specific activity change at one point in time. Thus, IMPLAN does not account for any subsequent behavioral adjustments that may occur in the economy. For example, a change in the NPS plan for snowmobile management within the park may encourage local businesses to diversify or modify their operations. These changes could thereby abate potential reductions in output and employment, a change not captured by IMPLAN. Further, IMPLAN does not estimate any potential re-employment of the labor force that may be displaced by management changes (for example the increased employment opportunity provided by guiding). Therefore, the long-run net output and employment impacts resulting from the modeled changes in winter use management would likely be smaller than those estimated by the model. The second caveat to the interpretation of the IMPLAN model estimates generated for this analysis is that they rely on the economic relationships derived from the latest data available, which are from 2008 (prior analyses relied on earlier IMPLAN data sets. Third, IMPLAN information is based on year-round data; winter seasonal information may not be as accurate. Fourth, for small analysis areas (West Yellowstone, Montana, for example) the IMPLAN data may not be an accurate representation of the actual economy due to lack of information. However, the most powerful use for economic modeling is in the comparisons between alternatives. The impacts of the six action alternatives on economic resources can be modeled and compared and the decision maker can understand the effects of the different alternatives.

IMPLAN Model Application

The modeling of the regional economic impacts associated with changes in visitation (and associated visitor spending) on an economic area requires several types of information.

1. **The change in the number of visitors to the different analysis areas in the greater Yellowstone area**. For the following analysis, the percentage of visitors to the park who did not live in each of the economic analysis areas was taken from the results of the 1997-1998 survey of winter park visitors (Duffield and Neher 2000). Specifically, 82.5% of visitors lived outside of the five-county area, 65.5% lived outside the three-state region, and 99% lived outside each of the three communities (Cody, Jackson, and West Yellowstone). Only non-local visitation was included in the IMPLAN model since only their spending drives local economic growth.
2. **The change in visitation is multiplied by the average spending per visitor**. The analyses from which the impacts are taken use $175.33 per visitor for all the alternatives except alternative 4, which uses $106.33 (Duffield and Neher 2006). As noted in these reports, per-visit expenditures were estimated using a time series model of West Yellowstone resort tax collections and west entrance visits (Duffield and Neher 2006). This regression model of winter visitation and tax receipts estimates that for every west entrance winter visit, $175.33 is spent on taxable goods and services in the community of West Yellowstone. Spending for alternative 4, which involves commercial wheeled vehicle access to the park through the north and west entrances, was estimated to cost approximately $69 less (Duffield and Neher 2006). This spending does not represent total trip spending for an individual because he or she may visit the park more than once on a trip or may visit other areas in the vicinity such as national forest lands.
3. **The IMPLAN model divides economic activity into industry categories, so the per visitor spending must be divided between categories**. The distribution of spending across economic sectors is also drawn from the 1997-1998 winter visitor survey (see Duffield and Neher 2006). That survey asked winter park visitors to detail their spending patterns within the greater Yellowstone area. Based on these responses, visitor spending was allocated as 27.5% lodging, 24.6% automotive and gas stations, 17.1% miscellaneous retail expenditures, 14.3% eating and drinking establishments, 11.5% scenic and recreational transportation, and 5% other amusement services.

Using the change in visitation, per visitor spending, and the distribution of spending across industry categories, an estimate is calculated for direct changes in non-resident visitor spending due to an action alternative and relative to the no-action alternatives. The direct spending changes by sector are then input into the IMPLAN program.

The IMPLAN program estimates total output and employment impacts, including indirect and induced impacts arising from the initial direct spending impact, and allocates these impacts across the sectors of the analysis area. Direct impacts reflect the initial spending at local businesses by visitors from outside the greater Yellowstone area (the change in direct spending described above). Indirect impacts reflect the ripple effect of this spending, as businesses pay for the inputs they need such as capital and labor. The induced effects reflect the resulting changes in household income for local residents.

At its most aggregated level, IMPLAN modeling applies output and employment multipliers to the initial visitor spending to arrive at estimated total output and employment impacts. In general, the smaller and less diverse the analysis area is, the closer its expenditure multiplier is to 1.0. Conversely, the larger and more diverse an economy, the larger are its multipliers.

Current Use Levels

Recent visitation data and trends are presented in the "Visitor Use and Experience" section of chapter 3. For the economic impact estimates, the 2005/2006 winter (a total of 88,718 visits) was selected as the assumed level of use for the current alternative (alternative 2). This level of use was selected to be consistent with Duffield and Neher (2006). In the 2005/2006 winter season, approximately 28,833 snowmobile passengers entered the park and 19,856 snowcoach passengers. For comparison, use levels for the 2009/2010 winter season there were 22,228 snowmobiles and 20,388 snowcoaches.

Assumptions for Recreational Use Levels by Alternative

Using the 2005/2006 visitation data, there was an average of 240 snowmobiles per day and 19 snowcoaches per day. Alternative 1 would allow no snowmobile or snowcoach access. Historically, motorized oversnow use has comprised more than 70% of the total winter visitation in the park. Nearly all visitors entered via the west, south, and east entrances. An analysis of the distribution of recreational use since the winter use management plan changes began in 2001 suggests little evidence of substitution between park entrances. Additionally, an analysis of snowmobile use on national forest land near the west entrance suggests that snowmobile use in national forests is possibly a complement to snowmobiling in the park rather than a direct substitute. For these reasons, the level of recreational use under the no-action conditions represented by alternative 1 was assumed to be equal to the north entrance wheeled vehicle entries plus parkwide skiing entries during the 2005/2006 winter for a total of 40,029 visits (NPS 2008a). Table 64 summarizes upper and lower bound visitation estimates. Estimates for alternatives 2 through 6 are based on estimates from previous reports (NPS 2007c; Duffield and Neher 2006). Alternative 7 offers different limits on snowmobiles and snowcoaches over the course of the season. For this alternative, the lower bound was set equal to visitation in 2005/2006 and for the upper bound, the assumption was that there would be 85 days in the season, 8 people per snowcoach, 1.3 people per snowmobile, and that 50,000 cars would enter the park. The lower bound was set equal to current visitation.

TABLE 64: LOWER AND UPPER BOUND VISITATION FORECASTS AND VISITOR SPENDING PER DAY ASSUMPTIONS

	Lower Bound Estimate	Upper Bound Estimate	Visitor Spending per day
Alternative 1	40,029	40,029	$175.33
Alternative 2	88,718	88,718	$175.33
Alternative 3	88,718	172,316	$175.33
Alternative 4	77,892	291,342	$106.33
Alternative 5	59,885	125,736	$175.33
Alternative 6	100,652	158,206	$175.33
Alternative 7	88,718	125, 736	$175.33

Source for alternatives 1-6: Duffield and Neher (2006) and NPS (2008a).

IMPLAN Results by Alternative

The resulting IMPLAN estimates for output and employment impacts relative to the alternative 1 are presented in tables 65 and 66 for the lower and upper bounds, respectively, for the three-state and five-county areas. Table 67 presents the results of the analyses for the communities of Cody and Jackson, Wyoming, and West Yellowstone, Montana. The size of the impacts in each area depend on the size of the multipliers used by the IMPLAN model, which can change over time based on changes in interrelationships between sectors of the economy and assumptions about the size of the revenue change within the region of interest. Because visitation from outside the region of interest is driving the regional economic impacts, the distribution of changes in visitation between resident and non-resident visitors is a key determinant of estimated impacts. Assumptions about visitation suggest that the non-resident visitor population increases as the size of the region of interest decreases. Since 66% of the total of new visitors comes from outside the three state area, only 66% of the new visitor spending is assumed to be new spending in the region that flows through the entire three-state economy. In the county model, the assumption was made that 82.5% of the visitors live outside the five counties, so 82.5% of the total new visitor spending is circulated within the smaller five-county region. Similarly, 99% of the total new visitor spending is injected into the each of the three individual communities. Although the multipliers are larger at the three-state level than the five-county level, the amount of new money injected into the five-county economy is larger than the amount of new money injected into the three-state economy. In some cases, the result is larger total impacts for the smaller geographic areas even though the multipliers are smaller. The same holds for the analysis at the community level.

TABLE 65: IMPACTS OF ACTION ALTERNATIVES RELATIVE TO NO-ACTION ALTERNATIVE (ALTERNATIVE 1) AND PERCENT CHANGE FROM TOTAL FOR THE 3-STATE AND 5-COUNTY REGIONS, LOWER BOUND VISITATION

Lower Bound	5-county area		3-state area	
	Total Output	Total Employment	Total Output	Total Employment
No-Action (Alternative 1)	$8,568,430,041	127,791	$130,462,241,081	1,942,947
Alternative 2	$8,199,085	108	$7,932,883	100
% change	0.096%	0.085%	0.006%	0.005%
Alternative 3	$8,199,085	108	$7,932,883	100
% change	0.096%	0.085%	0.006%	0.005%
Alternative 4	$1,073,248	15	$1,174,576	15
% change	0.013%	0.011%	0.001%	0.001%
Alternative 5	$3,343,692	44	$3,235,132	41
% change	0.039%	0.035%	0.002%	0.002%
Alternative 6	$10,208,736	135	$9,877,286	125
% change	0.119%	0.105%	0.008%	0.006%
Alternative 7	$8,199,085	108	$7,932,883	100
% change	0.096%	0.085%	0.006%	0.005%

TABLE 66: IMPACTS OF ACTION ALTERNATIVES RELATIVE TO NO-ACTION ALTERNATIVE (ALTERNATIVE 1) AND PERCENT CHANGE FROM TOTAL FOR THE 3-STATE AND 5-COUNTY REGIONS, UPPER BOUND VISITATION

Upper Bound	5-county area		3-state area	
	Total Output	Total Employment	Total Output	Total Employment
No-Action (Alternative 1)	$8,568,430,041	127,791	$130,462,241,081	1,942,947
Alternative 2	$8,199,085	108	$7,932,883	100
% change	0.096%	0.085%	0.006%	0.005%
Alternative 3	$22,276,745	294	$21,553,479	272
% change	0.260%	0.230%	0.017%	0.014%
Alternative 4	$23,012,676	304	$22,265,518	281
% change	0.269%	0.238%	0.017%	0.014%
Alternative 5	$14,432,809	190	$13,964,214	176
% change	0.168%	0.149%	0.011%	0.009%
Alternative 6	$16,836,219	220	$19,254,542	243
% change	0.196%	0.172%	0.015%	0.013%
Alternative 7	$14,432,809	190	$13,964,214	176
% change	0.168%	0.149%	0.011%	0.009%

TABLE 67: AVERAGE IMPACTS OF ACTION ALTERNATIVES RELATIVE TO NO-ACTION ALTERNATIVE (ALTERNATIVE 1) AND PERCENT CHANGE FROM TOTAL FOR THREE GATEWAY COMMUNITIES

Average	Cody, Wyoming		Jackson, Wyoming		West Yellowstone, Montana	
	Total Output	Total Employment	Total Output	Total Employment	Total Output	Total Employment
No-Action (Alternative 1)	$786,677,477	11,876	$1,854,443,978	22,565	$101,281,028	1,740
Alternative 2	$9,480,799	153	$9,118,021	106	$8,488,011	129
% change	1.21%	1.28%	0.49%	0.47%	8.38%	7.39%
Alternative 3	$17,619,968	284	$16,945,746	198	$15,774,881	239
% change	2.24%	2.39%	0.91%	0.88%	15.58%	13.73%
Alternative 4	$14,006,940	225	$13,470,969	157	$12,540,194	190
% change	1.78%	1.90%	0.73%	0.70%	12.38%	10.92%
Alternative 5	$10,277,698	165	$9,884,426	115	$9,201,462	139
% change	1.31%	1.39%	0.53%	0.51%	9.09%	8.01%
Alternative 6	$17,408,110	280	$7,000,257	122	$15,585,208	236
% change	2.21%	2.36%	0.38%	0.60%	15.39%	13.57%
Alternative 7	$9,879,249	159	$9,501,224	110.5	$8,844,737	134
% change	1.26%	1.34%	0.51%	0.49%	8.74%	7.70%

Cost of Meeting New Standards for Snowcoaches

As of December 15, 2014, all snowcoaches (diesel or gasoline) would have to meet EPA model year 2010 air emission requirements. This requirement could involve replacing engine and/or emission control systems so that the vehicle is in compliance, or purchasing 2010 or newer model year vehicles. Coaches would also need to meet a sound obligation that is similar to the snowmobile sound emission requirement. Once approved, a snowcoach could operate for 10 years without being upgraded or replaced.

Under all the alternatives except alternative 4, between 78 and 80 snowcoaches would be allowed to operate in Yellowstone per day. The actual number of snowcoaches needed depends on demand for snowcoach trips. In 2009/2010, on the peak day 66 snowcoaches entered the park. Alternative 4 would allow for up to 30 snowcoaches per day.

Out of the 78 snowcoach fleet in 2009/2010, approximately 29 are Bombardiers, and the balance (49) are vans to small and mid-size buses converted from wheeled vehicles in the summer to tracks and oversnow operations in the winter.

To calculate the cost of the snowcoach upgrades required by the alternatives, NPS assumed the following:

- The 29 Bombardiers would continue to operate and their engine and emission control systems would be upgraded to meet 2010 model year requirements. The cost would be approximately $10,000 per vehicle.

- Of the 51 conversion vehicles, as of 2014/2015, 10 percent (or 10 vehicles) would be 2010 or newer vehicles through normal replacement. No additional cost is assumed because they would be already replaced.
- Of the 41 remaining vehicles, owners would upgrade the engine and emission systems on 20 percent (or 8 vehicles) to meet 2010 standards. Cost per upgrade is approximately $10,000 per vehicle.
- The 33 remaining vehicles would be replaced.
- 25 percent (or 8) would be 12- to 15-passenger vans at a cost of $50,000 per vehicle.
- 50 percent (or 17) would be small airport-style vehicles at a cost of $160,000 per vehicle.
- 25 percent (or 8) would be mid-size buses at a cost of $200,000 each.

Based on these assumptions, the total cost of converting the current fleet to meet the new requirements would be approximately $5,090,000.

All snowcoach companies are also authorized to provide summer tours in the park. The 51 conversion vehicles would be available for wheeled summer tours; they are not purpose-built winter vehicles like the Bombardiers. Existing, older conversion vehicles could continue to be operated in the summer for wheeled vehicle tours. The investment in new vehicles would be spread over both seasons and a 10-year period.

Thresholds

The following thresholds for evaluating impacts on socioeconomic values were defined.

Negligible: The impact is at the lower levels of detection (< 5% change in either total output or employment)

Minor: The impact is slight, but detectable (5-10% change in either total output or employment)

Moderate: The impact is readily apparent and has the potential to become major (10-20% change in either total output or employment)

Major: The impact is severe, or if beneficial, has exceptional beneficial effects (>20% change in either total output or employment).

Study Area

The geographic area for the socioeconomic analysis includes the three state-area of Wyoming, Montana and Idaho; the five-county area of Fremont County in Idaho, Gallatin and Park counties in Montana, and Park and Teton counties in Wyoming; and the communities of Cody and Jackson, Wyoming, and West Yellowstone, Montana.

SUMMARY OF IMPACTS

A brief summary of the impacts to socioeconomic values is presented below, followed by the detailed impact analysis.

- Under alternative 1, the impacts would be long-term negligible adverse for the three-state area, the five-county area, and Cody and Jackson, Wyoming. West Yellowstone is projected to experience long-term minor adverse impacts. The adverse impacts would be most directly felt by communities and businesses near the park, especially in areas that have a higher proportion of business tied directly to park visitation. At the north entrance, Gardiner, Montana, might experience beneficial impacts if visitors who would have visited the other entrances switch to the North.
- Under alternative 2 there would be long-term beneficial impacts for the three-state area, the five county area, and the communities of Cody and Jackson. In West Yellowstone, the long-term beneficial impacts would be larger on average.
- Under alternative 3 there would be long-term beneficial impacts for the states, counties, and communities surrounding Yellowstone. West Yellowstone could experience larger beneficial, long-term impacts compared to the other communities. Alternative 3 has higher daily limits on snowmobile and snowcoach use, and so the alternative could accommodate higher growth in visitation than all the alternatives, except alternative 4. If demand for snowmobile and snowcoach tours grew beyond the current limits, alternative 3 would allow for a larger increase in visitation by out-of-region visitors.
- Under alternative 4, all of the communities would be expected to experience long-term beneficial impacts and West Yellowstone is expected to experience the largest beneficial impacts. The size of the impacts would depend on demand for commercial, wheeled vehicle tours out of the west and north entrances, which would represent a new winter experience for visitors.
- Under alternative 5 there would be long-term beneficial impacts for all the communities. In order to generate larger beneficial impacts under this alternative, demand for snowcoach tours must increase to more than make up for the eventual phase-out of snowmobiles.
- Under alternative 6 there would be long-term beneficial impacts for all the communities. West Yellowstone could experience larger, long-term beneficial impacts, on average. The larger beneficial impacts would be more likely under this alternative compared to others because of the provision for unguided snowmobile trips, which were historically more popular.
- Under alternative 7 there would be long-term beneficial impacts for all the communities. West Yellowstone could have larger, beneficial long-term impacts, on average due to the use levels permitted.

DETAILED IMPACT ANALYSIS

Below the impacts of each alternative are discussed. The impacts of alternative 1 (the no-action alternative) are described relative to current conditions (governed by the same rule as alternative 2). The impacts of alternatives 2 through 7 are described relative to the no-action alternative (alternative 1).

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Under alternative 1, no oversnow motorized recreational access would occur. Wheeled vehicle access would continue to occur through the north entrance of Yellowstone as far east as Cooke City, Montana. Of the four entrances, the west entrance and the community of West Yellowstone would experience the largest impacts over time, because the west entrance is the most popular entrance point into Yellowstone for snowmobiles and snowcoaches. Although some visitors would visit the area to snowmobile in the national forests or cross-country ski in Yellowstone and on trails near West Yellowstone, traffic through the entrance would be almost completely shut down. Similarly, traffic through the east and south entrances is almost completely via snowmobiles and snowcoaches in the winter season. With no motorized oversnow access, the Old Faithful Snow Lodge and the yurt camp at Canyon would be closed for the winter. The north entrance would experience the smallest change in visitation, since visitors could still drive in by car.

If visitation is low enough, the resulting reduction in business in the affected communities would lead to a loss of year-round population. A year-round population provides a more stable tax base and gives the community the ability to provide public services that may not be possible with a very small year-round population.

Alternative 1 represents what would happen if no new rule is passed, and oversnow motorized access for visitors were prohibited. Compared to the levels permitted under the 2009 interim rule, which is alternative 2, alternative 1 would result in lower visitation. Table 64 lists the visitation projections under each alternative. Visitation under alternative 1 is projected to be about half of 2009/2010 levels (alternative 2). This projection assumes that the north entrance would continue to receive approximately the same number of visitors, but the other entrances would service the small number of non-motorized visitors to the park. The number of cross-country skiers and other non-motorized visitors might increase if new visitors who want a non-motorized experience start visiting, but the increase is not expected to be large.

Based on the visitation numbers in table 64 and the impacts of alternative 2 relative to alternative 1 in tables 65, 66 and 67, the impact of alternative 1 over time would be a reduction in output and employment form the levels expected under alternative 2. The impacts are estimated to be negligible, adverse, and long term for Cody and Jackson, Wyoming. West Yellowstone is projected to experience minor, adverse, long-term impacts. At the north entrance, Gardiner, Montana, might experience beneficial impacts if visitors who would have visited the other entrances switch to the North. The five-county and three-state regions would experience negligible, adverse, long term impacts.

The terms negligible and minor represent the thresholds defined above, and not subjective descriptions of how the impacts would feel to the individuals who do experience a loss of business or employment. For these individuals, the effects would not seem negligible or minor. For example, the 2008 EA reported that business owners along the North Fork of the Shoshone River stated that if the east entrance is closed under alternative 1, most of them would close their businesses in the winter. Further exacerbating their situation is the recent downturn in visitation that has already caused some of the businesses to curtail operations or close entirely in the winter (NPS 2008a). The IMPLAN modeling captures the indirect and induced effects as well. As individual businesses are adversely affected, they would reduce purchases of other goods and services from suppliers. Conversely, if individual businesses are beneficially affected they would increase the purchase of goods and services from suppliers. These feedback effects impact sectors of the economy beyond those that are influenced directly by visitors.

Cumulative Impacts

Increasing population, oil and gas leasing, and economic opportunities over time should provide beneficial impacts to the economy of the greater Yellowstone area. As long as the growth and economic activity are managed in a way that does not harm park resources and potentially park visitation, these trends should boost economic growth. Road construction in the area may depress visitation in the short-term, but should be beneficial once the construction is completed. Plans for improvements to nearby attractions such as ski resorts could also bring additional visitors into the area.

For example, the Sleeping Giant Ski Resort near the east entrance to the park reopened in 2009. In addition, there is a development plan for the Rendezvous Ski Trail. Activities in the surrounding national forests also impact greater Yellowstone area. These plans should improve the management of the forests and contribute to the overall wellbeing of the greater Yellowstone area. The Gallatin National Forest Travel Plan, revised in 2006, is being implemented along with the Beartooth District of Custer National Forest Travel Management Plan and thee Gallatin National Forest Travel Plan. Over time, consolidating the checkerboard lands on the Gallatin National Forest should also benefit the forest and the surrounding area. Specific projects in the park that have (or would have) a generally beneficial bearing on socioeconomics include the construction of a new west entrance and reconstruction of the east entrance road. These longer-term beneficial projects may depress visitation in their implementation phase. For example, road construction projects are aggravating to most drivers, some of whom may avoid the portion of the park (and nearby communities) where road work is occurring. Similarly, replacing visitor centers often means a temporary facility is provided (construction activities may also result in disturbance). This may also be discouraging to some visitors.

Finally, the current economic recession is having a dampening effect on the national and local economy; however, despite the poor economic conditions visitation to Yellowstone increased somewhat in the winter of 2010 compared to 2009. As discussed in chapter 3, unemployment has increased in the counties and states that border Yellowstone. Timber harvesting on USFS land has also been decreasing.

With the prohibition of motorized oversnow recreational use, and the lack of access to the interior of the park, alternative 1 would likely discourage out-of-state visitors from traveling to the area and contributing to local regional economies. It is likely that this alternative would represent an overall negligible adverse impact on regional economic trends. In the current economic conditions, a decline in winter visitors would contribute to the overall weaker economy. When the economy recovers, a reduction in park visitation would be somewhat offset by the beneficial regional economic trend related to resource extraction, residential growth, other recreation opportunities, and wildlife and other natural environment attractions.

The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible adverse impacts of alternative 1, would result in long-term negligible adverse impacts in the towns of Jackson and Cody. In West Yellowstone, as long as the economic downturn continues, the long-term minor adverse impacts expected from alternative A could result in negligible to minor adverse cumulative impacts, of which alternative 1 would contribute a large part.

Conclusion

The impacts are estimated to be negligible, adverse, and long term for the three-state area, the five-county area and Cody and Jackson, Wyoming. West Yellowstone is projected to experience minor, adverse, long-term impacts. As described earlier, the adverse direct impacts would be most directly felt by communities and businesses near the park, especially in areas that have a higher proportion of business tied directly to park visitation. At the north entrance, Gardiner, Montana, might experience beneficial impacts if visitors who would have visited the other entrances switch to the North. The IMPLAN modeling captures the indirect and induced effects as well. As individual businesses are adversely affected, they would reduce purchases of other goods and services from suppliers. Conversely if individual businesses are beneficially affected they would increase the purchase of goods and services from suppliers. These feedback effects impact sectors of the economy beyond those that are influenced directly by visitors. Cumulative impacts would be long-term negligible adverse or beneficial cumulative impacts on the socioeconomic environment. In West Yellowstone cumulative negligible to minor adverse impacts could result.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Alternative 2 continues the current management, which allows up to 318 snowmobiles per day and 78 snowcoaches. The visitation estimate is based on 2005-06 visitation, when the up to 720 snowmobiles per day were allowed. The limit of 318 would have been exceeded 29 times in 2007/2008 and 6 times in 2008/2009. For the past two seasons, the limit of 318 has not been reached. Compared to alternative 1, alternative 2 would result in beneficial, long-term impacts for the three-state area, the five-county area, and the three communities. In West Yellowstone, the average beneficial impacts shown in table 67 are larger than the other areas. As discussed in chapter 3, after an initial drop-in visitation after the new rules were implemented, visitation increased for the first three winters. In the last two winters, visitation was higher than in 2004/2005 but lower than 2005/2006 through 2007/2008. Although winter visitation dropped when the new rules went into place, most communities still saw rising tax revenues through 2006. The exception is West Yellowstone, where tax revenues dropped along with visitation. Alternative 2 provides for continued growth in visitation, especially through the use of snowcoaches. The beneficial impacts would be tempered by the cost of upgrading the existing snowmobile fleet to meet new requirements by December 2014.

Cumulative Impacts

The impacts of these past, present, and reasonably foreseeable future actions would be the same as under alternative 1. The impacts of these actions combined with the long-term beneficial impacts of alternative 2, would result in long-term beneficial impacts (of which alternative 2 would contribute a large part) in the towns of Jackson, Cody, and West Yellowstone.

Conclusion

In conclusion, compared to alternative 1, alternative 2 would result in beneficial, long-term impacts for the three-state area, the five county area, and the communities of Cody and Jackson. In West Yellowstone, the beneficial, long-term impacts would be larger on average. Alternative 2 continues current management, under which there has been some increase in visitation, especially for snowcoach use. Cumulative impacts would be long-term beneficial.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Alternative 3 would allow expanded snowmobile use with a daily limit of 720. However, guided snowmobile tours would still be required. The lower bound estimate for visitation shown in table 64 assumes that visitation would remain at current levels, since simply raising the daily limit would not necessarily generate more visitors, at least in the short term. The upper bound estimate assumes growth in both snowmobile and snowcoach trips. If demand for visits increased to the daily limit, alternative 3 would allow the one of the highest numbers of visitors into the park. As with the other alternatives that allow snowcoach use in the park, businesses would have to bear the cost of upgrading the existing snowmobile fleet to meet new requirements by December 2014. Alternative 3 is expected to result in beneficial, long-term impacts for the three-state area, the five-county area, and the towns of Jackson and Cody, Wyoming. As shown in table 67, West Yellowstone could experience larger beneficial, long-term impacts on average, given that the community attracts a larger share of winter visitation. As mentioned above, for the businesses and individuals who experience the benefits, the benefits may not be negligible. The impacts would be negligible in comparison to the entire economy of the region being analyzed.

Cumulative Impacts

The impacts of these past, present, and reasonably foreseeable future actions would be the same as under alternative 1. The impacts of these actions, combined with the long-term beneficial impacts of alternative 3, would result in long-term beneficial impacts (of which alternative 3 would contribute a large part) in the towns of Jackson, Cody, and West Yellowstone.

Conclusion

Alternative 3 is expected to result in negligible to beneficial, long-term impacts for the states, counties and communities surrounding Yellowstone. West Yellowstone could experience larger beneficial, long-term impacts compared to the other communities. Alternative 3 has higher daily limits on snowmobile and snowcoach use, and so the alternative could accommodate higher growth in visitation than all the alternatives, except alternative 4. If demand for snowmobile and snowcoach tours grew beyond the current limits, alternative 3 would allow for a larger increase in visitation by out-of-region visitors. However, the lower estimate of visitation is equal to alternative 2 because the snowmobiles must still be part of a guided tour and must meet BAT restrictions. Cumulative impacts would be long-term beneficial.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Alternative 4 provides for a variety of winter use experiences that currently offered. For this reason, it is difficult to forecast visitation, which would depend on demand for commercial, wheeled vehicle tours from the west and north entrances. The upper bound estimate for visitation is much higher than the other alternatives, so this alternative allows for the most growth in visitation. Because the daily limit for snowmobiles is 110 and the limit for snowcoaches is only 30, the growth in visitation depends on visitor demand for commercial wheeled vehicle trips and the park's ability to keep the roads plowed. Under the upper bound assumptions, the daily limits for snowmobiles, snowcoaches, and commercial wheeled vehicles are all met. The daily limits for snowmobiles and snowcoaches are lower than alternatives 2, 3, and 6, which would result in lower overall visitation if there is not demand for wheeled vehicle tours. In addition, per visitor spending is expected to be lower because wheeled vehicle tours would be less expensive than snowmobile or snowcoach tours. The cost of upgrading the existing snowmobile fleet to meet new requirements by December 2014 could be lower than other alternatives that allow more snowcoaches into the park. The impacts in tables 65, 66, and 67 overstate the beneficial impacts of alternative 4 because they are based on a similar alternative from the 2007 EIS that allowed 350 snowmobiles per day and 40 snowcoaches.

The town of West Yellowstone could experience on average larger beneficial impacts, whereas the other areas and communities are expected to experience smaller, beneficial, long-term impacts.

Cumulative Impacts

The impacts of these past, present, and reasonably foreseeable future actions would be the same as under alternative 1. The impacts of these actions, combined with the long-term beneficial impacts of alternative 4, would result in long-term beneficial impacts (of which alternative 4 would contribute a large part) in the towns of Jackson, Cody, and West Yellowstone.

Conclusion

Compared to alternative 1, all the communities are expected to experience beneficial, long-term impacts and West Yellowstone is expected to experience the largest beneficial impacts. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term beneficial impacts of alternative 4 would result in long-term beneficial cumulative impacts on the socioeconomic environment. The size of the impacts would depend on demand for commercial, wheeled vehicle tours out of the west and north entrances, which would represent a new winter experience for visitors. Cumulative impacts would be long-term beneficial.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Alternative 5 would transition to BAT snowcoaches starting in the 2014/2015 season. Snowcoach limits would increase with demand, while snowmobile limits were reduced during a five-hear phase-out. Until the phase-out begins, alternative 5 would have similar impacts to alternative 2. Because alternative 5 ultimately allows for about 40 additional snowcoaches per day, more visitors could be accommodated under alternative 5 than under alternatives 1 and 2, but less than under the other alternatives. At the same time, greater use of snowcoaches would increase the cost to businesses that would be required to upgrade the existing snowmobile fleet to meet new requirements by December 2014.

Compared to alternative 1, alternative 5 is expected to bring beneficial, long-term impacts for all the communities, as seen in table 67. The larger beneficial impacts would only materialize if visitor demand for snowcoach tours increases, because over time snowmobiles would be phased out. The impact estimates in table 67 likely underestimate the beneficial impacts in the near term, because the impacts are based on an alternative from the 2007 EIS did not allow for a phase-out period, but switched directly to snowcoach-only trips. Tables 65 and 66 show a similar pattern for the three-state area and the five-county area.

Cumulative Impacts

The impacts of these past, present, and reasonably foreseeable future actions would be the same as under alternative 1. The impacts of these actions, combined with the long-term beneficial impacts of alternative 5, would result in long-term beneficial impacts (of which alternative 5 would contribute a large part) in the towns of Jackson, Cody, and West Yellowstone.

Conclusion

Compared to alternative 1, alternative 5 is expected to have on average beneficial, long-term impacts for all the communities, as seen in tables 65, 66 and 67. In order to generate larger beneficial impacts under this alternative, demand for snowcoach tours must increase to more than make up for the eventual phase-out of snowmobiles. Cumulative impacts would be long-term beneficial.

Impacts of Alternative 6: Implement Variable Management

Alternative 6 would allow for variable limits on snowmobiles and snowcoaches. Based on the visitation forecasts in table 64, alternative 6 has the highest lower bound estimate for visitation. Alternative 6 is the only alternative that allows for unguided snowmobile trips. Under this alternative, up to 25% of the snowmobiles could be for unguided commercial use. Given the popularity of unguided (or non-commercially guided) trips historically, it is expected that the daily limit for unguided trips would be reached regularly during the winter. The variable limits might also attract more visitors who want a non-motorized experience than alternatives with constant daily limits for motorized recreation. Similar to the other alternatives that allow snowcoach use in the park, businesses would have to bear the cost of upgrading the existing snowmobile fleet to meet new requirements by December 2014.

Compared to alternative 1, alternative 6 could provide beneficial long-term impacts for all the communities, with the possibility of larger beneficial impacts in West Yellowstone.

Cumulative Impacts

The impacts of these past, present, and reasonably foreseeable future actions would be the same as under alternative 1. The impacts of these actions combined with the long-term beneficial impacts of alternative 6, would result in long-term beneficial impacts (of which alternative 6 would contribute a large part) in the towns of Jackson, Cody, and West Yellowstone.

Conclusion

Compared to alternative 1, alternative 6 could provide beneficial, long-term impacts for all the communities, the three-state area, and the five-county area. West Yellowstone could experience larger, beneficial long-term impacts, on average, as reported in tables 65, 66 and 67. The larger beneficial impacts are more likely under this alternative compared to others because of the provision for unguided snowmobile trips, which were historically more popular. Cumulative impacts would be long-term beneficial.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Alternative 7 includes three sets of daily limits on snowmobiles and snowcoaches that would be in place during different times of the season to provide a variety of experiences. Based on the visitation forecasts shown in table 64, alternative 7 has the fourth highest upper bound visitation level (the same as alternative 5) and the second highest lower bound visitation level (the same as alternatives 2 and 3). The daily limits would be set in advance allowing visitors to plan their trips accordingly. The alternative allows for growth in visitation, while still providing opportunities for visiting the park in uncrowded conditions. Similar to the other alternatives that allow snowcoach use in the park, businesses would have to bear the cost of upgrading the existing snowmobile fleet to meet new requirements by December 2014. Compared to alternative 1, alternative 7 could provide beneficial long-term impacts for all the communities. The community-level impacts presented in table 67 are conservative estimates; based on visitation levels, the output and employment impacts are expected to fall between those of alternative 2 and alternative 5.

Cumulative Impacts

The impacts of these past, present, and reasonably foreseeable future actions would be the same as under alternative 1. The impacts of these actions combined with the long-term beneficial impacts of alternative 7, would result in long-term beneficial impacts (of which alternative 7 would contribute a large part) in the towns of Jackson, Cody, and West Yellowstone.

Conclusion

Compared to alternative 1, alternative 7 could provide beneficial, long-term impacts for the three-state area, the five-county area, and the three communities. West Yellowstone could reach larger, beneficial, long term impacts, on average, as reported in tables 65, 66 and 67. Cumulative impacts would be long-term beneficial.

PARK OPERATIONS AND MANAGEMENT

GUIDING REGULATIONS AND POLICIES

The NPS, park concessioners, contractors, researchers, and other duly permitted parties depend on snowmobiles and snowcoaches for their administrative functions. These uses of the park are not within the purpose and need, but are within the scope of analysis in this EIS because as shown in the analysis for some impact topics, such as soundscapes, winter operations have an effect. Likewise, these uses are not part of the decision to be made relative to this plan. When considering park operations, specifically winter operations, the following regulations and policies were taken into account:

- Executive Order 11644 (Use of Off-Road Vehicles on the Public Lands, section 2(3)(B) and (C))
- NPS *Management Policies 2006*, section 8.2.3
- February 17, 2004, memorandum from Assistant Secretary, Fish and Wildlife and Parks, to Director, NPS
- 36 CFR 1.2 (d)

In essence, because administrative use of OSVs can adversely impact park resources and values, it is to be limited to the level necessary for management of public use or to conduct emergency operations, construction, and resource protection activities that cannot be accomplished by other means.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY DEFINITIONS

The topic of park management and operations, for the purpose of this analysis, refers to the quality and effectiveness of park staff to maintain and administer park resources and provide for an appropriate visitor experience during the winter season. The impact analysis is based on the current description of park operations presented in "Chapter 3: Affected Environment" of this document.

To assess the level of impact to winter operations for each alternative, the following were considered:

- NPS staffing requirements
- Available funding to implement the plan
- Operating environment and conditions.

The following are intensity definitions for evaluating impacts on park management and operations.

Negligible: Park operations would not be affected or the effect would be at or below the lower levels of detection and would not have an appreciable effect on park operations.

Minor: The effect would be detectable, but would be of a magnitude that would not have an appreciable effect on park operations. If changes are needed to offset adverse effects, they would be relatively simple and likely successful.

Moderate: The effects would be readily apparent and would result in a change in park operations in a manner noticeable to staff and the public. Changes would probably be necessary to offset adverse effects and would likely be successful.

Major: The effects would be readily apparent and would result in a change in park operations in a manner noticeable to staff and the public and would be markedly different from existing operations. Changes to offset adverse effects would be needed, would be extensive, and their success could not be guaranteed.

Assumptions

The cost of implementing the alternatives in this draft plan/EIS includes the operational costs that would occur if an alternative were implemented. This information can help the reader see the cost differences among the alternatives. For example, the cost of plowing versus grooming roads is illustrated. Similarly, the cost of conducting avalanche control, or not, is illustrated in the alternatives.

The costs in this analysis are not the total costs of operating the park in the winter. For example, utility costs (propane, oil, electricity, water, and sewer) are not included. Other costs related to the overall administration of the park (for example, contracting services, personnel services, safety services, budget and finance, and overall park management) are not included in the costs. Winter monitoring costs are also not included because the program would be similar across most alternatives (with the possible exception of alternative 1). The initial costs of implementing the alternatives are generally not included, except where a specific building would need to be built to implement an alternative.

Although the actual length of the winter season is typically 91 or 92 days, the cost assumptions include preparation time prior to the start of the winter season and are common across all alternatives.

Study Area

The study area for park operations is the boundaries of Yellowstone and areas where winter use occurs.

SUMMARY OF IMPACTS

- Alternative 1 would have long-term negligible adverse impacts to park operations because staffing and resource requirements would be covered by existing funding, as well as long-term benefits from the potential reallocation of staff to other areas of the park during the winter season. In addition, fuel requirements and green house gas emissions would be reduced from current levels as the number of staff needed in the interior of the park, and therefore use of OSVs, would be reduced.

- Alternative 2 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded, and this level of funding would be expected to continue. Any additional required resources may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations.
- Alternative 3 would result in long-term minor to moderate adverse impacts because the staffing and resource requirements would require additional funding that may or may not be available in the annual park budget. Any additional required resources may impact park operations and could be slightly noticeable to park staff and visitors as resources are reallocated from one part of the park to another.
- Alternative 4 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations.
- Alternative 5 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative as well as the slight increase in funding required over current conditions may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations.
- Alternative 6 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded (if not slightly lower), and this level of funding would be expected to continue. Any additional required resources may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations.
- Alternative 7 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded (if not slightly lower), and this level of funding would be expected to continue. Any additional required resources may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations.

DETAILED IMPACT ANALYSIS

Impacts of Alternative 1: No Snowmobile/Snowcoach Use

Under alternative 1, OSV use would be limited to minimal administrative use. No recreational OSV use would be permitted in the park in the winter. With the minimal level of OSV use, the amount of staff resource and funding needed to implement winter management in the park would decrease from current levels, or levels that were required for the 2009/2010 and 2010/2011 winter seasons. To implement alternative 1, minimal winter keeper/caretaker staff would be needed at each developed area for operation of the housing, garage/office, water treatment plant, and the wastewater treatment plant. Winter upkeep would require staff time and the resources to house staff for the winter. Buildings in the interior of the park may need to be operational to allow concessionaires to carry out winter keeping of structures. In total, about 28 NPS staff would be needed in the park at different developed areas to provide seven-day-per-week coverage and an adequate margin of safety under alternative 1. Grooming an access route between each developed area would occur as needed, approximately once per week. The south and east entrance roads would not be groomed.

Although many buildings in the interior of the park would be closed for the winter season under alternative 1, complete shutdown of some buildings, even if they are not being used (such as the newer visitor centers) may not be feasible due to the electronics and other systems that were not designed for total shutdown.

Table 68 details the costs associated with implementing alternative 1. In total, implementation of alternative 1 would cost about $1,744,880 annually. Because no additional facilities would be needed to implement alternative 1, there would be no one-time costs associated with this alternative.

TABLE 68: APPROXIMATE COSTS OF IMPLEMENTING ALTERNATIVE 1

Activity	Cost
Groom Snow Roads	$95,680
Plow Roads	$0
Spring Opening	$789,000
Snowmobile Maintenance	$75,480
Tracked Vehicle Maintenance	$50,000
Sylvan Pass Avalanche Management	$0
NPS Staff	$734,720
Sand Removal	$0
Approximate Total	$1,744,880

Costs under alternative 1 would be less than those currently funded, therefore ample funds and staff resources would be available for implementing this alternative. Because park operations would not be affected or the effect would be at or below the lower levels of detection, impacts to park operations and maintenance from the cost of implementing alternative 1 would be long-term negligible adverse. In terms of green house gas emissions and fuel consumption, as park staff would be reduced from a current level of 82 to 28, fuel requirements and associated emissions would be reduced. Long-term benefits would also occur as staff currently assigned to winter use activities in the park could be reassigned to other areas, taking additional burden off park staff and resources in other areas of the park.

Cumulative Impacts

Actions with the potential to impact park operations include the activities within the park that require additional time and resources from NPS staff during the winter months. These activities include past construction projects (the construction of a new West Entrance and of the East Entrance road) as well as the current and future operation of these projects. In addition to these construction projects, visitor activities occurring outside of the interior of the park would require staff time and resources. One example of this type of activity includes managing the park concessioners that operate lodging accommodations at Mammoth Hot Springs and provide other services such as evening programs, guided ski and snowshoe tours, wildlife tours, ski shop and repair center, massage therapy, hot tub rentals, and ice skating rinks. In addition, a yurt camp is available at Canyon, which is currently operated by one of the park's snowcoach outfitters. NPS staff also provides ranger-led winter programs that offer insight into the history, culture, and geography of the park. Winter programs begin when the park opens for the winter season December 15 and end on March 15. All of these actions would require various levels of staff time and resources, however, the funds for these activities are part of annual funding cycles and would be accommodated with existing and expected budgets. If additional resources are needed for these activities, such as operating a new facility, they would be accommodated by existing funding or by the reallocation of existing staff. The impacts of these actions would have no to little effect on park operations, and if detectable, would not be of a magnitude that would not have an appreciable effect on park operations, resulting in long-term negligible to minor impacts.

The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible adverse impacts of alternative 1, would result in long-term negligible to minor adverse cumulative impacts on park operations and maintenance. Alternative 1 would contribute a large amount to these actions because the reduction in the need for OSV management during the winter season would impact a large portion of the park's budget during this time.

Conclusion

Alternative 1 would have long-term negligible adverse impacts to park operations because staffing and resource requirements would be covered by existing funding, as well as long-term benefits from the potential reallocation of staff to other areas of the park during the winter season. In addition, fuel requirements and green house gas emissions would be reduced from current levels because the number of staff needed in the interior of the park, and therefore OSV use, would be reduced. Cumulative impacts under alternative 1 would be long-term, negligible to minor adverse, of which alternative 1 would contribute a large part.

Impacts of Alternative 2: Continue Snowmobile/Snowcoach Use at 2008 Plan Limits

Alternative 2 would continue to allow for use levels permitted under the 2009 interim rule, which allows up to 318 snowmobiles per day and 78 snowcoaches. As a result, staffing levels needed under alternative 2 would be similar to those observed over the 2009/2010 and 2010/2011 winter seasons, and would represent the cost of park winter operations in recent years. Sylvan Pass would be open and avalanche control activities would continue. Eighty-two park employees would continue to remain duty stationed in interior locations, including the West Entrance, to execute winter management activities. One-third of their year would be allocated to the winter season (including preparation and post-season work). One-hundred twenty six snowmobiles are in the park's administrative fleet, along with 14 tracked vehicles and these OSVs would be expected to continue operating using fuel expenditures similar to those in the 2009 interim rule. As part of this management, the NPS would continue to transition to an almost an entirely leased fleet of snowmobiles. To further accommodate winter use activities in the park, the park would continue to groom 180 miles of snow roads, currently an average of every third day. Alternative 2 would also include constructing a new warming hut at Old Faithful. In terms of green house gas emissions and fuel consumption, park staff would be kept at levels similar to the 2009/2010 and 2010/2011 winter seasons, and would continue to consume approximately 23,000 gallons of bio-diesel and 14,000 gallons of ethanol over the winter season.

Table 69 details the costs associated with implementing alternative 2. Alternative 2 would cost $3,967,350 to implement each year, plus the one-time cost ($200,000) for a new warming hut at Old Faithful.

TABLE 69: APPROXIMATE COSTS OF IMPLEMENTING ALTERNATIVE 2

Activity	Cost
Groom Snow Roads	$314,640
Plow Roads	$0
Spring Opening	$789,000
Snowmobile Maintenance	$317,030
Tracked Vehicle Maintenance	$70,000
Sylvan Pass Avalanche Management	$325,000
NPS Staff	$2,151,680
Sand Removal	$0
Approximate Total	$3,967,350

Because costs under alternative 2 would be similar to those currently funded for the past two winter seasons (2009/2010 and 2010/2011), it would be expected that the needed funds and staff resources would be available for implementing this alternative. Additional one-time costs could occur (such as establishment of a new warming hut at Old Faithful) that could require additional resources, but it is expected that the impacts from additional costs would have little to no effect on park management and operations. If an effect is detectable, it would not be of a magnitude that would have an appreciable effect on park operations. Therefore, under alternative 2 impacts to park operations and management would be long-term, negligible to minor adverse.

Cumulative Impacts

Impacts on park operations and management from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible to minor adverse impacts of alternative 2, would result in long-term negligible to minor adverse cumulative impacts, of which alternative 2 would contribute a large amount because winter use management activities constitute a large portion of the park's operating budget during the winter season.

Conclusion

Alternative 2 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded, and this level of funding would be expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 2 would be long-term negligible to minor adverse, of which alternative 2 would constitute a large part.

Impacts of Alternative 3: Return Snowmobile/Snowcoach Use to 2004 Plan Limits

Alternative 3 would allow for an increase in the number of OSVs allowed in the park compared to the 2009 interim rule. Winter use management under alternative 3 would allow for up to 720 snowmobiles and 78 snowcoaches per day in the park. The increase in the number of OSVs allowed per day would require a small increase in staff over the number of staff required for the 2009/2010 and 2010/2011 winter seasons. Similar to alternative 2, the operation of Sylvan Pass would continue, but the costs of operations would not increase over alternative 2. The use from additional OSVs would also require additional grooming activities; grooming would be expected to occur every other day. In order to carry out the winter use management activities required to implement alternative 3, approximately 90 NPS employees would be duty stationed in the interior of Yellowstone. In additional 90 snowmobiles and 16 tracked vehicles would be required for these staff. In terms of green house gas emissions and fuel consumption, park staff and the number of OSVs for them would be increased slightly over 2009/2010 and 2010/2011 winter seasons levels, and would therefore require a slight increase in fuel consumption and associated emissions.

Table 70 details the costs associated with implementing alternative 3. Alternative 3 would cost $4,346,360 annually to implement, plus the $200,000 cost for a new warming hut at Old Faithful.

TABLE 70: APPROXIMATE COSTS OF IMPLEMENTING ALTERNATIVE 3

Activity	Cost
Groom Snow Roads	$463,680
Plow Roads	$0
Spring Opening	$789,000
Snowmobile Maintenance	$327,080
Tracked Vehicle Maintenance	$80,000
Sylvan Pass Avalanche Management	$325,000
NPS Staff	$2,361,600
Sand Removal	$0
Approximate Total	$4,346,360

With the increased level of use as compared with the past two winter seasons (2009/2010 and 2010/2011), additional funding of approximately $380,000 would be required to implement alternative 3. Much of this funding is expected to be available from current sources, but the additional staff time and resources may need to be accomplished by reallocating resources from other areas of the park. Also, additional onetime costs could occur (such as establishment of a new warming hut at Old Faithful) that could require additional resources. Any changes to park operations from the additional funding needed under alternative 3 may be noticeable to the staff or the public, and resources may need to be moved from one part of the park to another in order to accommodate additional funding needed. However, even if noticeable, these changes are expected to be small, resulting in long-term minor to moderate adverse impacts to park operations and management under alternative 3.

Cumulative Impacts

Impacts on park operations and management from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term minor to moderate adverse impacts of alternative 3, would result in long-term minor to moderate adverse cumulative impacts, of which alternative 3 would contribute a large amount because winter use management activities constitute a large portion of the park’s operating budget during the winter season.

Conclusion

Alternative 3 would result in long-term minor to moderate adverse impacts because the staffing and resource requirements would require additional funding that may or may not be available in the park's annual budget. Any additional resources required may impact park operations and could be slightly noticeable to park staff and visitors when resources are allocated from one part of the park to another. Cumulative impacts under alternative 3 would be long-term minor to moderate adverse, of which alternative 3 would constitute a large part.

Impacts of Alternative 4: Mixed-Use: Snowcoaches, Snowmobiles, and Road Plowing for Wheeled Vehicles

Alternative 4 provides for a different variety of winter use experiences than those currently offered at the park. This alternative would provide for a lower level of OSV use than occurred during the past two winter seasons (2009/2010 and 2010/2011). This alternative would also reduce the amount of road that requires grooming for OSVs but would add additional visitation opportunities including commercial wheeled vehicle access that would increase the overall visitor access to the park in the winter season. In addition to expenses for park staff operations and OSVs (including maintenance, fuel, and grooming), alternative 4 would also require the use of park resources for road plowing, sand removal, and additional structures such as a sand and vehicle storage shed. Alternative 4 would also include the closure of Sylvan Pass, and therefore would not include any costs associated with management in this area during the winter season.

Under alternative 4, 78 employees would be required and 70 park OSVs. There would be a slight reduction in the amount of required grooming (a decrease in 65 miles throughout the park), staff at the east entrance and throughout the park, and park OSVs needed over current levels due to the reduced number of OSVs permitted in the park. However, much of this cost savings would be offset by the requirements for road plowing and sand removal for spring opening. In terms of green house gas emissions and fuel consumption, park staff and the number of OSVs for them, as well as the addition of commercial wheeled vehicles, would be increased slightly over 2009/2010 and 2010/2011 winter seasons levels, and would therefore require a slight increase in fuel consumption and associated emissions.

Table 71 details the costs associated with implementing alternative 4. Alternative 4 would cost about $3,415,334 to implement, plus $850,000 for new warming huts at Old Faithful and Norris and a sand and vehicle storage building at the west entrance.

TABLE 71: APPROXIMATE COSTS OF IMPLEMENTING ALTERNATIVE 4

Activity	Cost
Groom Snow Roads	$171,304
Plow Roads	$457,240
Spring Opening	$531,310
Snowmobile Maintenance	$150,960
Tracked Vehicle Maintenance	$50,000
Sylvan Pass Avalanche Management	$0
NPS Staff	$2,046,720
Sand Removal	$7,800
Approximate Total	$3,415,334

Costs for implementing alternative 4 would be slightly less than funding for the past two winter seasons (2009/2010 and 2010/2011). It would be expected that the needed funds and staff resources would be available for implementing this alternative. Additional one-time costs could occur, such as establishment of a new warming hut at Old Faithful as well as a sand and vehicle storage facility. These one-time costs could require additional resources, but it is expected that the impacts from additional costs would have little to no effect on park management and operations. If detectable, these costs would not be of a magnitude that would have an appreciable effect on park operations. Therefore, impacts under alternative 4 to park operations and management would be long-term, negligible to minor adverse.

Cumulative Impacts

Impacts on park operations and management from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible to minor adverse impacts of alternative 4, would result in long-term negligible to minor adverse cumulative impacts, of which alternative 4 would contribute a large amount because winter use management activities constitute a large portion of the park's operating budget during the winter season.

Conclusion

Alternative 4 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 4 would be long-term negligible to minor adverse, of which alternative 4 would constitute a large part.

Impacts of Alternative 5: Transition to Snowcoaches meeting BAT Requirements Only

Alternative 5 would transition OSV use in the park to BAT snowcoaches starting in the 2014/2015 season. Snowcoach limits would increase with demand and snowmobile limits would be reduced during a five-hear phase-out. Until the phase-out begins, alternative 5 would have impacts similar to alternative 2. Because alternative 5 would ultimately allow for about 40 additional snowcoaches per day, more visitors could be accommodated under alternative 5 than under alternatives 1 and 2, but less than under the other alternatives. Although the total number of OSVs in the park would be reduced, the number and location of routes would stay the same as currently permitted, and grooming requirements would likely increase to every other day because snowcoaches cause more rutting and damage to snow roads than snowmobile use.

Under alternative 5, approximately 82 employees would be required for winter use management activities in the interior or the park, the same number as under the 2009 interim rule. Due to the decrease in the overall number of OSVs permitted, the administrative fleet for the park would be slightly reduced from current levels (2009/2010 and 2010/2011 winter season) to approximately 100 snowmobiles, with a slight increase in tracked vehicles to 20. Sylvan Pass would be open and avalanche control activities would continue.

In terms of green house gas emissions and fuel consumption, park staff and the number of OSVs to support them would be similar to funding required for the 2009/2010 and 2010/2011 winter seasons, and would therefore not result in a large increase in fuel consumption and associated emissions.

Table 72 details the costs associated with implementing alternative 5. Alternative 5 would cost $4,080,960 when fully implemented, plus $200,000 for a new warming hut at Old Faithful.

TABLE 72: APPROXIMATE COSTS OF IMPLEMENTING ALTERNATIVE 5

Activity	Cost
Groom Snow Roads	$463,680
Plow Roads	$0
Spring Opening	$789,000
Snowmobile Maintenance	$251,600
Tracked Vehicle Maintenance	$100,000
Sylvan Pass Avalanche Management	$325,000
NPS Staff	$2,151,680
Sand Removal	$0
Approximate Total	$4,080,960

Cost for implementing alternative 5 would be slightly more (by approximately $113,000) than funding for the past two winter seasons (2009/2010 and 2010/2011), but it would be expected that the needed funds and staff resources would be available for implementing this alternative. Additional one-time costs could occur (such as establishment of a new warming hut at Old Faithful) that could require additional resources. It is expected that the impacts from additional costs would have little to no effect on park management and operations. If detectable, it would not be of a magnitude that would have an appreciable effect on park operations. Therefore, impacts under alternative 5 to park operations and management would be long-term, negligible to minor adverse.

Cumulative Impacts

Impacts on park operations and management from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible to minor adverse impacts of alternative 5, would result in long-term negligible to minor adverse cumulative impacts, of which alternative 5 would contribute a large amount because winter use management activities would constitute a large portion of the park's operating budget during the winter season.

Conclusion

Alternative 5 would result in long-term negligible to minor adverse impacts to park operations and management because the staffing and resource requirements for implementation of the alternative would likely be met with existing funding sources. Additional requirements (one-time costs) of this alternative as well as the slight increase in funding required over current conditions may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 5 would be long-term negligible to minor adverse, of which alternative 5 would constitute a large part.

Impacts of Alternative 6: Implement Variable Management

Alternative 6 would allow for variable limits on snowmobiles and snowcoaches, as well as up to 25% of unguided or non-commercially guided use. Although use limits under alternative 6 may reach levels higher than currently permitted on some days, the variation in use would also allow for days of lower use. With this variation, on the whole, staffing and OSV requirements under alternative 6 would be the same as under alternative 2. However, alternative 6 provides for closure of the east side of the park during the last two weeks of the season, slightly reducing grooming requirements on 60 miles of road during this time. In addition, under alternative 6, the operation of Sylvan Pass would continue and a new warming hut would be established at Old Faithful, similar to alternative 2. In terms of green house gas emissions and fuel consumption, park staff levels would be similar to the 2009/2010 and 2010/2011 winter seasons, and would continue to consume approximately 23,000 gallons of bio-diesel and 14,000 gallons of ethanol over the winter season.

Table 73 details the costs associated with implementing alternative 6. Alternative 6 would cost \$3,953,550 to implement plus an additional \$200,000 for a new warming hut at Old Faithful.

TABLE 73: APPROXIMATE COSTS OF IMPLEMENTING ALTERNATIVE 6

Activity	Cost
Groom Snow Roads	$300,840
Plow Roads	$0
Spring Opening	$789,000
Snowmobile Maintenance	$317,030
Tracked Vehicle Maintenance	$70,000
Sylvan Pass Avalanche Management	$325,000
NPS Staff	$2,151,680
Sand Removal	$0
Approximate Total	$3,953,5500

Costs under alternative 6 would be similar, if not slightly less due to decreased plowing requirements, to those currently funded for the past two winter seasons (2009/2010 and 2010/2011). Therefore, it would be expected that the needed funds and staff resources would be available for implementing this alternative. Additional one-time costs could occur, such as establishment of a new warming hut at Old Faithful, that could require additional resources. But it is expected that the impacts from additional costs would have little to no effect on park management and operations, and if an effect is detectable, would not be of a magnitude that would have an appreciable effect on park operations. Therefore, impacts under alternative 6 to park operations and management would be long-term, negligible to minor adverse.

Cumulative Impacts

Impacts on park operations and management from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible to minor adverse impacts of alternative 6, would result in long-term negligible to minor adverse cumulative impacts, of which alternative 6 would contribute a large amount because winter use management activities constitute a large portion of the park's operating budget during the winter season.

Conclusion

Alternative 6 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to those currently funded (if not slightly lower), and this level of funding expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 6 would be long-term negligible to minor adverse, of which alternative 6 would constitute a large part.

Impacts of Alternative 7: Provide a Variety of Use Levels and Experiences for Visitors (NPS Preferred Alternative)

Similar to alternative 6, alternative 7 would allow for variable limits on snowmobiles and snowcoaches. Use limits and the number of OSVs in the park would be similar to or less than the number of OSVs during the 2009/2010 and 2010/2011 winter seasons, depending on the use level that particular day. With this variation, on the whole, staffing and OSV requirements under alternative 7 would be the same as under alternative 2. However, alternative 7 provides for closure of the east side of the park during the last two weeks of the season, slightly reducing grooming requirements on 60 miles of road during this time. In addition, under alternative 7, the operation of Sylvan Pass would continue and a new warming hut would be established at Old Faithful, similar to alternative 2. In terms of green house gas emissions and fuel consumption, park staff levels would be similar to the 2009/2010 and 2010/2011 winter seasons, and would continue to consume approximately 23,000 gallons of bio-diesel and 14,000 gallons of ethanol over the winter season.

Table 74 details the costs associated with implementing alternative 7. Alternative 7 is expected to cost $3,953,550 per year to implement, plus $200,000 for a new warming hut at Old Faithful.

TABLE 74: APPROXIMATE COSTS OF IMPLEMENTING ALTERNATIVE 7

Activity	Cost
Groom Snow Roads	$300,840
Plow Roads	$0
Spring Opening	$789,000
Snowmobile Maintenance	$317,030
Tracked Vehicle Maintenance	$70,000
Sylvan Pass Avalanche Management	$325,000
NPS Staff	$2,151,680
Sand Removal	$0
Approximate Total	$3,953,5500

Costs under alternative 7 would be similar (if not slightly less due to decreased plowing requirements) to funding for the 2009/2010 and 2010/2011 winter seasons. Therefore, it would be expected that the needed funds and staff resources would be available for implementing this alternative. Additional one-time costs could occur, such as establishment of a new warming hut at Old Faithful, that could require additional resources, but it is expected that the impacts from additional costs would have little to no effect on park management and operations. If an effect is detectable, it would not be of a magnitude that would have an appreciable effect on park operations. Therefore, impacts under alternative 7 to park operations and management would be long-term, negligible to minor adverse.

Cumulative Impacts

Impacts on park operations and management from other past, present, and reasonably foreseeable future actions would be the same as described for alternative 1. The impacts of these past, present, and reasonably foreseeable future actions, combined with the long-term negligible to minor adverse impacts of alternative 7, would result in long-term negligible to minor adverse cumulative impacts, of which alternative 7 would contribute a large amount because winter use management activities constitute a large portion of the park's operating budget during the winter season.

Conclusion

Alternative 7 would result in long-term negligible to minor adverse impacts because the staffing and resource requirements would be similar to current funding (if not slightly lower), and this level of funding would be expected to continue. Any additional resources required may impact park operations, but through other funding sources or reallocation of resources, would not have a noticeable impact on park operations. Cumulative impacts under alternative 7 would be long-term negligible to minor adverse, of which alternative 7 would constitute a large part.

CHAPTER 5

Consultation and Coordination

CHAPTER 5: CONSULTATION AND COORDINATION

Yellowstone National Park staff place a high priority on meeting the intent of public involvement in the National Environmental Policy Act (NEPA) process and providing the public an opportunity to comment on proposed actions. As part of the National Park Service (NPS) NEPA process, issues associated with the plan/EIS were identified during scoping meetings with NPS staff (including the Inter-disciplinary Team, coordination with other affected agencies, public meetings, and public comment). For this project, an Inter-disciplinary Team, also called the Project Team, consisted of members from the park, region, and Washington Office. The purpose of the Project Team is to provide a framework for shared decision-making.

This chapter describes the consultation that occurred during development of this Winter Use Plan and Environmental Impact Statement (plan/EIS), including consultation with stakeholders and other agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the draft document.

THE SCOPING PROCESS

The NPS divides the scoping process into two parts: internal scoping and external public scoping. Internal scoping involved discussions among NPS personnel regarding the purpose of and need for management actions, issues, potential management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people are given an opportunity to comment and contribute early in the decision-making process. For this plan/EIS, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given a variety of opportunities to express concerns or views and identify important issues or even other alternatives or alternative elements.

Taken together, internal and public scoping are essential elements of the NEPA planning process. The following sections describe the various ways scoping was conducted for this project.

INTERNAL SCOPING

Internal scoping for the plan/EIS was held December 16–18, 2009, to discuss the development of a plan/EIS with staff members from the park, Department of the Interior, NPS Environmental Quality Division, NPS Intermountain Region, and NPS Air Resources Division. This group is collectively referred to as the Project Team. Contractor personnel assisted in facilitating the internal scoping meetings and public scoping meetings. During the three-day internal scoping meeting, the NPS identified the purpose of and need for action, management objectives, issues, and impact topics. The Project Team also discussed possible alternative elements, cumulative impacts, and strategies for public involvement throughout the process.

The Project Team coordinated with technical experts during the planning process and established a Science Advisory Team to provide input to this plan. Comprised of subject matter experts, the Science Advisory Team was chartered to advise and provide technical recommendations to the NPS on matters regarding scientific data and analysis. The team met periodically, providing technical background information and research references for this plan/EIS. Science Advisory Team participants included individuals with scientific background in the fields of air quality, acoustic resources, wildlife biologists, and social scientists. The Science Advisory Team wrote a report that summarized available scientific information related to the effects of winter use at the park, identified key findings, quantitative methods of assessing the potential effects of winter use, and proposed future research to help address questions that could not be resolved. This report, the Scientific Assessment of Yellowstone National Park Winter Use, is available at the Yellowstone Winter Use website at http://www.nps.gov/yell/planyourvisit/winteruse.htm and the PEPC website at http://parkplanning.nps.gov/yell.

PUBLIC SCOPING

Public scoping began on January 29, 2010, with the release of the public scoping brochure and Federal Register publication of the Notice of Intent to prepare an environmental impact statement (75 FR 4842-4843). The Notice of Intent summarized the history of winter use management at the park, discussed the purpose and need of the plan/EIS, addressed the focus of the alternatives, listed the project website, and announced the upcoming public scoping meetings. The park posted the public scoping newsletter on the NPS Planning, Environment, and Public Comment (PEPC) website at http://parkplanning.nps.gov/yell, sent copies of the newsletter to a list of park stakeholders, and issued a news release inviting the public to comment at the scoping meetings.

The public was invited to submit comments on the scope of the planning process and potential alternative elements from January 29, 2010, through March 30, 2010. During this time, the park received more than 9,000 documents commenting on the scope of the plan/EIS. Generally, these comments focused on how the alternative concepts presented could be improved or suggested new elements to be considered. Many comments focused on the potential impact on local communities associated with limiting or changing winter use at the park. Additionally, many comments were received about the experience the visitor would have depending on changes in winter use. Comments were also received that expressed concern for wildlife and their habitat with the use of OSVs in the park. Public comments recommended incorporating additional tours and programs at the park and implementing a fee or permit system for OSV use. Comments indicated the use of OSVs either contributed to or detracted from visitor experiences at the park. A full summary and analysis of the public comments received can be found at http://parkplanning.nps.gov/yell.

During the scoping period, six public scoping open houses were held at the following locations:

- Hilton Garden Inn in Idaho Falls, Idaho on February 16, 2010
- Hilton Garden Inn in Billings, Montana on February 18, 2010
- Little America Hotel in Cheyenne, Wyoming on March 15, 2010
- Old Post Office Pavilion in Washington, D.C. on March 17, 2010
- Cody Club Room of the Cody Auditorium in Cody, Wyoming on March 22, 2010
- West Yellowstone Visitor Information Center meeting room in West Yellowstone, Montana on March 24, 2010.

The meetings offered a variety of methods for the public to provide comments. NPS personnel and contractor staff were present at each display to answer questions from attendees and record attendees' comments. Members of the public were given the opportunity to ask questions following a presentation given by the park. Comment sheets were provided to meeting attendees as an additional method for accepting public comments. Park staff were on hand to answer questions and provide additional information to open house participants. To keep the public involved and informed throughout the planning process, individuals were given the option to receive notification of the availability of the draft range of alternatives and draft plan/EIS documents.

During the scoping period, the park received comments on the purpose, need, objectives, and suggestions for alternatives that should be considered in this draft plan/EIS and incorporated these suggestions into a range of draft alternatives. All together, more than 9,000 letters and web submissions were received. These draft alternatives were provided to the public through a newsletter that was mailed and emailed to the park's mailing list for winter use. The public was give an opportunity to ask questions related to the draft range of alternative through a series of web and phone based meetings. On August 3 and 5, 2010, the park held two one-hour webinars to explain the draft of range of alternatives and to answer questions about them. Additionally on August 4, 2010, the park hosted a one-hour telephone conference call, which allowed for individuals who did not have computer access to participate in the process.

COOPERATING AGENCIES

In January 2010, the NPS sent invitations to federal and state agencies involved in past winter use planning efforts, inviting them to become cooperating agencies for this winter use planning process. The following entities responded that they would serve as cooperating agencies for this effort: the U.S. Environmental Protection Agency; State of Idaho; State of Montana; State of Wyoming; Fremont County, Idaho; Gallatin County, Montana; Park County, Montana; Park County, Wyoming; and Teton County, Wyoming. The U.S. Forest Service and U.S. Fish and Wildlife Service declined the invitation to be cooperating agencies.

As a cooperating agency, most entities signed a Memorandum of Understanding to define the role of each party in the process, including providing technical data and reviews. In addition to the roles stated in the Memorandum of Understanding, the cooperating agencies met during the planning process to provide the NPS information. These meetings included the following:

- In-person meeting, February 18, 2010, Billings, Montana. During this meeting, cooperating agency members were introduced to the planning process and asked to provide input on the purpose, need, and objectives of the plan. Cooperating agency members were also asked to identify issues they felt should be considered in this planning process.
- Teleconference, August 9, 2010. During this teleconference, cooperating agencies were given the opportunity to provide input on the draft range of alternatives. They were also asked to provide any data that had not yet been shared that they felt should be considered in the plan/EIS.

LIST OF RECIPIENTS

The agencies, organizations, and businesses listed below were notified of the availability of the draft plan/EIS. This document was also mailed to other entities and individuals who requested a copy.

CONGRESSIONAL DELEGATES

- Raúl Labrador, Idaho, U.S. House of Representatives
- Michael K. Simpson, Idaho, U.S. House of Representatives
- Mike Crapo, Idaho, U.S. Senate
- James Risch, Idaho, U.S. Senate
- Denny Rehberg, Montana, U.S. House of Representatives

- Jon Tester, Montana, U.S. Senate
- Max Baucus, Montana, U.S. Senate
- John Barrasso, Wyoming Senator
- Mike Enzi, Wyoming Senator
- Cynthia Lummis, Wyoming U.S. House of Representative

NATIONAL PARK SERVICE

- Big Hole National Battlefield
- Glacier National Park
- Grand Teton National Park
- Grant-Kohrs Ranch NHS
- Little Bighorn Battlefield NM

U.S. FOREST SERVICE

- Beaverhead National Forest
- Bridger-Teton National Forest
- Custer National Forest
- Gallatin National Forest
- Shoshone National Forest
  Targhee National Forest

ENVIRONMENTAL PROTECTION AGENCY

- Region 8 – Denver

U.S. ARMY CORPS OF ENGINEERS

U.S. FISH AND WILDLIFE SERVICE

WESTERN FEDERAL LANDS HIGHWAY DIVISION

STATE OF IDAHO

- C.L. “Butch” Otter, Governor of Idaho
- Idaho Department of Commerce
- Idaho Department of Parks and Recreation
- Idaho Fish and Game Department
- Idaho State Historic Preservation Office
- Freemont County, Idaho, Commissioners

State of Montana

- Brian Schweitzer, Governor of Montana
- Montana Department of Commerce
- Montana Department of Fish Wildlife and Parks
- Montana Intergovernment Review Clearinghouse
- Town of West Yellowstone
- Gallatin County, Montana, Commissioners
- Park County, Montana, Commissioners

State of Wyoming

- Matt Mead, Governor of Wyoming
- Wyoming Department of Environmental Quality
- Wyoming Department of Transportation
- Wyoming Game and Fish Department
- Wyoming Office of Federal Land Policy
- Wyoming State Clearinghouse
- Wyoming State Historic Preservation Office
- Wyoming State Lands and Investments
- Wyoming Travel Commission
- Park County, Wyoming, Commissioners
- Teton County, Wyoming, Commissioners
- Teton County Certified Local Government

American Indian Tribes

Yellowstone’s 26 Associated Indian Tribes:

- Assiniboine & Sioux Tribes
- Blackfeet Tribe
- Cheyenne River Sioux Tribe
- Coeur d'Alene Tribe
- Comanche Tribe of Oklahoma
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Reservation
- Confederated Salish & Kootenai Tribes
- Crow Tribe

- Crow Creek Sioux Tribe
- Eastern Shoshone Tribe
- Flandreau Santee Sioux Tribe
- Gros Ventre and Assiniboine Tribes
- Kiowa Tribe of Oklahoma
- Lower Brule Sioux Tribe
- Nez Perce Tribe
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Shoshone-Bannock Tribes
- Sisseton-Wahpeton Sioux Tribe
- Spirit Lake Sioux Tribe
- Standing Rock Sioux Tribe
- Turtle Mountain Band of the Chippewa Indians
- Yankton Sioux Tribe

LIBRARIES

- Billings, Montana Public Library
- Bozeman, Montana Public Library
- Cody, Wyoming Public Library
- Jackson, Wyoming Public Library
- West Yellowstone, Montana, Public Library
- Wyoming State Library
- Yellowstone National Park Research Library

OTHER ORGANIZATIONS AND BUSINESSES

- Alliance for Wild Rockies
- American Fisheries Society
- American Wildlands
- Animal Welfare Institute
- Bear Creek Council
- Beartooth Alliance

- Billings Chamber of Commerce
- Bluewater Network
- Bozeman Area Chamber of Commerce
- Buffalo Bill Historical Center
- Center for Urban Affairs
- Cheyenne High Plains Audubon
- Citizens for Teton Valley
- Coalition of National Park Service Retirees
- Cody Chamber of Commerce
- Cooke City/Silver Gate Chamber of Commerce
- Defenders of the Rockies
- Defenders of Wildlife
- Fremont County Audubon Society
- Fund for Animals
- Gardiner Chamber of Commerce
- Great Bear Foundation
- Greater Yellowstone Coalition
- Delaware North, Inc.
- Humane Society of the United States
- Idaho Falls Chamber of Commerce
- Idaho Wildlife Federation
- Jackson Hole Alliance for Responsible Planning
- Jackson Hole Chamber of Commerce
- Lander Chamber of Commerce
- Livingston Chamber of Commerce
- Montana Audubon Council
- Montana State Preservation Office
- Montana State University
- Montana Wildlife Federation
- National Audubon Society
- National Parks Conservation Association
- National Wildlife Federation
- Natural Resource Conservation Service – Bozeman and Cody

- Nature Conservancy – Idaho Chapter
- Nature Conservancy – Montana Chapter
- Nature Conservancy – Wyoming Chapter
- Northern Plains Resource Council
- Northern Rockies Conservation Cooperative
- Northwestern University
- Park County Environmental Council
- Pinedale Chamber of Commerce
- Red Lodge Chamber of Commerce
- Riverton Chamber of Commerce
- Sacajawea Audubon Society
- Sierra Club Idaho Chapter
- Sierra Club Northern Plains Regional Office
- Sierra Club Teton Group
- Sierra Club Utah Chapter
- Snake River Audubon Society
- Star Valley Development Association
- Stone Fly Society
- Teton County Historic Preservation Board
- University of Colorado
- University of Wyoming
- Upper Missouri Breaks Audubon Society
- Utah Audubon Society
- Utah Wilderness Association
- Utah Wildlife Federation
- West Yellowstone Chamber of Commerce
- Wild Forever
- Wilderness Society
- Wyoming Association of Professional Historians
- Wyoming Heritage Society
- Wyoming Hospitality and Retail Network
- Wyoming Outdoor Council
- Wyoming Wildlife Federation

- Xanterra Parks and Resorts
- Yellowstone Association
- Yellowstone Park Foundation
- Yellowstone Valley Audubon Society

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GLOSSARY

adaptive management—A system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and, if not, facilitating management changes that will best ensure that outcomes are met or to re-evaluate the outcomes. Adaptive management recognizes that knowledge about natural resource systems is sometimes uncertain and is the preferred method of management in these cases (source: Departmental Manual 516 DM 4.16).

alternatives—Sets of management elements that represent a range of options for how, or whether to proceed with a proposed action. An environmental assessment or environmental impact statement analyzes the potential environmental impacts of the range of alternatives, as required under National Environmental Policy Act (NEPA).

Best Available Technology (BAT)—BAT is a term applied with regulations on limiting pollutant discharges with regard to abatement strategy.

buffer—A protective area or distance surrounding a sensitive resource that limits visitor access.

cumulative effect or impact—The impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.6).

ecology—The pattern of relations between organisms and their environment.

environmental consequences—Environmental effects of project alternatives, including the proposed action, any adverse environmental effects which cannot be avoided, the relationship between short term uses of the human environment, and any irreversible or irretrievable commitments of resources which would be involved if the proposal should be implemented (40 CFR 1502.16).

Executive Order—Official proclamation issued by the President that may set forth policy or direction or establish specific duties for federal agencies in connection with the execution of federal laws and programs.

Federal Register—Published by the Office of the Federal Register, National Archives and Records Administration (NARA), the Federal Register is the official daily publication for rules, proposed rules, and notices of federal agencies and organizations, as well as executive orders and other presidential documents (http://www.gpoaccess.gov/fr/).

federally listed endangered species—An endangered species is one that is in danger of extinction throughout all or a significant portion of its range. Before a species can receive protection under the ESA, it must first be placed on the federal list of endangered species. All actions leading up to and including listing of a species as endangered are published in the Federal Register (USFWS Endangered Species Program).

habitat—The environment in which a plant or animal lives (includes vegetation, soil, water, and other factors).

habituation—the psychological process in humans and other organisms in which there is a decrease in psychological and behavioral response to a stimulus after repeated exposure to that stimulus over a duration of time. In some instances, apparent habituation could also mean an animal is under physiological stress and would, under healthy circumstances, respond to the threat.

IMPLAN—An economic impact assessment modeling system that allows the user to build economic models to estimate the impacts of economic changes.

mitigation—"Mitigation" as defined in the National Environmental Policy Act (40 CFR 1508.20), includes: avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its Implementation; rectifying the impact of repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; compensating for the impact by replacing or providing substitute resources or environments.

monitoring—A process of collecting information to evaluate if an objective and/or anticipated or assumed results of a management plan are being realized (effectiveness monitoring) or if implementation is proceeding as planned (implementation monitoring).

planning—An interdisciplinary process for developing short- and long-term goals and alternatives for visitor experience, resource conditions, projects, facility type and placement, and other proposed actions.

population (or species population)—A group of individual plants or animals that have common characteristics and interbreed among themselves and not with other similar groups.

preferred alternative—The alternative in an EA or EIS that the agency believes would best fulfill the purpose and need for action.

scoping—An early and open process for determining the extent and variety of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7).

soundscape (natural)—The aggregate of all the natural, nonhuman-caused sounds that occur in parks, together with the physical capacity for transmitting natural sounds.

threatened or endangered species—Plants or animals that receive special protection under federal or state laws, including the Endangered Species Act. Species may be listed threatened or endangered in the state, but not by the federal government (USFWS), or vice versa. Some USFWS regional offices also maintain a list of those species of special concern, either nationally or locally, which may be being or may have been previously considered for listing as threatened or endangered.

threatened species—Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

ungulate—A hoofed, typically herbivorous, animal; includes deer, elk, and bison.

visitor experience—The perceptions, feelings, reactions, and activities of a park visitor in relationship to the surrounding environment.

visitor use—The types of recreation activities engaged in by visitors, including the type of activity, visitor behavior, timing, and distribution of use.

visitor—In this plan, anyone who physically visits a park for recreational, educational or scientific purposes, or who otherwise uses a park's interpretive and educational services.

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Appendices

APPENDIX A: ADAPTIVE MANAGEMENT AND POTENTIAL FUTURE STUDIES

ADAPTIVE MANAGEMENT AND POTENTIAL FUTURE STUDIES

This appendix describes the winter use plan's adaptive management framework and some potential future studies that illustrate the types of information that may be useful for developing changes in future winter use management.

ADAPTIVE MANAGEMENT

Adaptive management recognizes that there are uncertainties surrounding the management of natural systems and helps natural resource managers respond to resource or system conditions through time and the collection and evaluation of addition information. Knowing uncertainties exist provides managers the ability to consider them in their planning and the latitude to change direction when deemed necessary. Adaptive management improves manager's understanding of ecological systems to better achieve management objectives and suggest changes in action to improve progress towards desired outcomes.

The emphasis in an adaptive approach is first and foremost on resource management. The value of understanding, and the monitoring and analysis that produce understanding, is inherited from their contributions to the objectives of resource management. Although the focus is on learning, the ultimate goal of the effort is smart management. It is important to recognize that adaptive management is a complex endeavor that includes much more than simply following a sequence of steps. Properly executed, the process involves ongoing, real-time learning, both in a technical sense and in terms of process itself. Stakeholders need to be engaged at the stage of initial problem formulation and remain engaged throughout implementation (Williams et al. 2007).

ACTIVE VERSUS PASSIVE ADAPTIVE MANAGEMENT

There are two different forms of adaptive management which results in different approaches to addressing uncertainty in natural resource management. Active adaptive management focuses on the learning aspect through a "management by experiment" approach where specific experiments are carried out to better understand the resource response and reduce uncertainty. Passive adaptive management also recognizes that there is uncertainty in natural resource management; however, the focus is on achieving prescribed management objectives. Learning and the reduction of uncertainty is also a component of passive adaptive management, but it is more of a by-product of the process. (Williams et al. 2007). The adaptive management framework described for the winter use plan is a passive adaptive management approach.

ADAPTIVE MANAGEMENT PROCESS

Adaptive management is a continuing iterative process where the problem is first assessed, potential management actions are designed and implemented, those actions and resource responses are monitored over time, that data is evaluated, and actions are adjusted if necessary to better achieve desired management outcomes (See figure A-1).

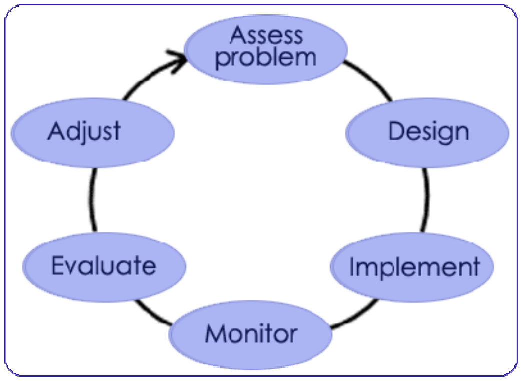


Diagram from Williams et al. 2007.

FIGURE A-1. GENERAL ADAPTIVE MANAGEMENT PROCESS

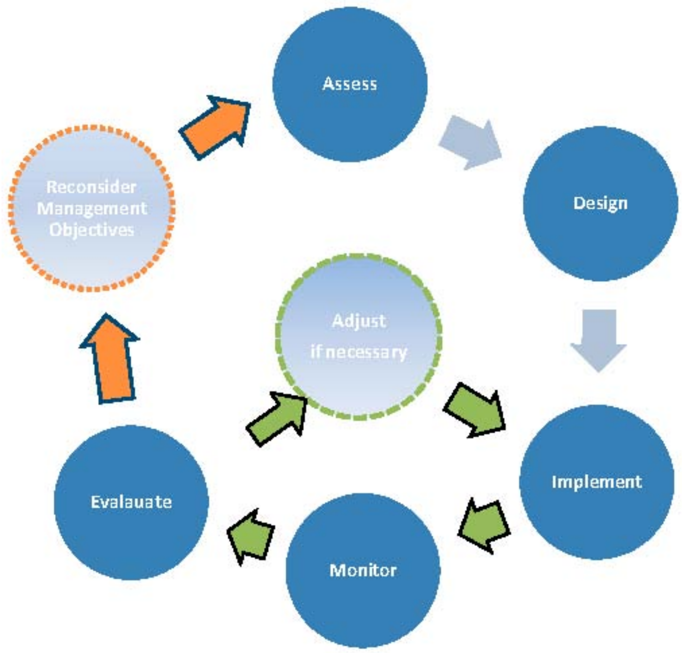
Williams identifies nine steps in adaptive management. These steps can be categorized into two phases: the set-up phase and the iterative phase.

Set-Up Phase	**Iterative Phase**
1. Stakeholder Involvement	6. Decision Making
2. Objectives	7. Follow-up Monitoring
3. Management Actions / Alternatives	8. Assessment
4. Models	9. Iteration
5. Monitoring Plans	

The set-up phase includes the "Assess the Problem" and "Design" portion of figure X above while the iterative phase includes "Implement," "Monitor," "Evaluate," and "Adjust."

Through this and previous winter planning processes, steps 1-5 of the Set-up phase have been completed, though could be revisited in the future. The Record of Decision is step 6 in her Iterative phase.

Adaptive management plan is different from monitoring in that it allows park managers to act when information exists about a specific resource but there is still some level of uncertainty. A key step in adaptive management is to develop and implement a management scenario (preferred alternative) based on the best available information. As part of this adaptive management planning process, management objectives were developed. In addition, metrics were established for each affected resource in terms of impact intensity definitions. These objectives and metrics were established to help a manager understand the results of a monitoring program and as guides for taking future actions if a problem is perceived. Failure maintain or achieve an objective does not mean that the actions being taken are resulting in unacceptable results. In fact, it could provide managers an insight when conditions may be moving away from those that are desirable or that the original objectives need to be revised (double-loop learning). For this reason, adaptive management objectives could be adjusted in the future, based on monitoring information, research, stakeholder input, and best professional judgment (See figure A-2).



The green arrows indicate the single loop learning where actions are *Implemented*, conditions are M*onitored*, data is *Evaluated*, and actions are *Adjusted* (if necessary) or continue to be *implemented*. Double loop learning is based on the concept that upon data being *Evaluated* there is a determination to *Reconsider Management Objectives,* this results in initiating the *Assess* and *Design* stages of the adaptive management cycle.

FIGURE A-2. AN ILLUSTRATION OF SINGLE LOOP AND DOUBLE LOOP LEARNING INHERENT IN AN ADAPTIVE MANAGEMENT APPROACH

After taking a management action, the next step is to implement a monitoring program. Monitoring is a critical step in the process, as it focuses on collecting data that can be used to evaluate the response of the system or resource to the implemented management action. This evaluation plays a vital role within the framework of adaptive management because of the level of uncertainty in initial predictions. Managers then review results of the evaluation program and determine whether to maintain the implemented management action, adjust management actions to better meet objectives, or revisit original objectives.

This winter use plan recognizes that there is a certain amount of uncertainty in how specific resources will respond or be affected by the implementation of an alternative. An adaptive management approach will help decrease the level of uncertainty and adjust actions as necessary based on responses or effects and the Park's overall objectives. The affected resources that will be monitored over time include wildlife and wildlife habitat, air quality, soundscapes, health and safety, and visitor use and experience.

Park personal will monitor those resource described above during the winter use season in terms of how they are affected by the implementation of the preferred alternative and provide that information to Park management to evaluate on a monthly basis. This information would be compared with how the resources were expected to be affected by the preferred alternative. In addition to information related to resource response to OSV use levels, the Park will also consider the totality of information that would have bearing on the resources including such environmental and other factors such as overall winter severity, weather impacts, motorized and non-motorized use patterns, among others.

If based on the evaluation of the monitoring data, Park management determines that an OSV use change is necessary, it would implement some type of response action. These potential management response options are those future actions that the Park may consider taking in order to better achieve or maintain objectives. These management options or subsequent actions are described generally in order to illustrate the types of actions that may be taken and understand the types of potential impacts associated with those actions. These management options or actions could include requiring new low-emission technologies, adjusting the number of daily vehicle entries permitted, establishing timed-entry requirements, requiring new low-sound technologies, closing certain areas to OSV use, adjusting the duration of the winter use season, and increasing recreational and educational opportunities for other visitors, among others options.

It is expected that full implementation of the preferred alternative would not be realized for up to four winter seasons. In addition, once the preferred alternative is fully implemented it would likely require several (3-4) winter seasons in order to adequately determine if the objectives are being met or if there is a positive trend to suggest they will be met fully in the future. Some potential response action would occur in the interim in order to avoid unpredicted effect given OSV use and environmental and other conditions. The identification of negative trends may suggest the need to implement a management response option. No change in condition would suggest either that the amount of time has not been sufficient to measure a change in conditions or the action is one that will not result in a change. In this situation, the Park may consider adjusting the action through the implementation of a response options or continuing to monitor the resources for additional winter seasons.

Once it is determined that a subsequent action is necessary and desirable to better achieve plan objectives, an analysis will be conducted to determine what if any additional environmental processes may be required under NEPA. Some actions may be implemented quickly, as they are within the scope of the preferred alternative and their impacts have been adequately assessed. Some non-emergency actions, such as designating a new route for oversnow vehicle travel, may require additional site-specific NEPA analysis, which includes public involvement. This NEPA analysis could take several different forms including a tiered Environmental Assessment and corresponding Finding of No New Significant Impacts if those impacts have been adequately evaluated in the overarching EIS (43 CFR 46.140). Other actions might be administrative in nature or could be implemented through application of a categorical exclusion under NEPA.

The adaptive management framework will ensure the park’s obligation to preserve resources and values in an acceptable condition, while allowing for winter use of the park.

POTENTIAL FUTURE STUDIES

As part of the process of developing this EIS, a group of scientists and managers were convened to determine the types of information that may prove useful in informing the long term management of resources at Yellowstone National Park, including those prevalent during the OSV winter use period. The implementation of any of the studies described below would be subject to available funding and prioritized based on the Park’s need. The list of studies listed below is not exhaustive but rather illustrative of the types of studies that may be suggested.

As additional baseline information is gathered and analyzed, these studies may be used in the future to modify the adaptive management framework described above including the development of adaptive management objectives, monitoring methods, and potential management responses. These studies are listed and described below in terms of soundscapes, wildlife, and visitor use and experience; however, the scientific study of other resources would also likely be informative.

SOUNDSCAPES (ACOUSTIC RESOURCES)

- Assess methods for understanding the duration of peak noise levels.
- Evaluate the two noise models being used to better understand their application when predicting the spatial and temporal extent of audible OSV noise.

WILDLIFE

- Investigate cumulative effects of winter use on wildlife habitat selection, rates of movements, time budgets, and levels of activity.
- Investigate the winter availability of forage for ungulates and implications of variable use for plant communities considering OSV use.
- Investigate distribution, abundance, probabilities of occupancy, and detection rates of park wildlife where current knowledge is lacking.
- Continue to understand bison use of winter roads through implementation of studies, such as "Evaluating Key Uncertainties Regarding Road Grooming and Bison Movements" (Garrot and White 2007).

SOCIAL SCIENCE

- Investigate visitor and/or local displacement during the winter use periods.
- Assess the potential for social and economic impacts from Yellowstone winter use management in areas surrounding the park.

AIR QUALITY

- Assess effects of changes to snowmobile and snowcoach technology on OSV air emissions.

REFERENCES

Williams, B.K., R.C. Szaro, and C.D. Shapiro

2007 *Adaptive Management: The U.S. Department of the Interior Technical Guide*. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

Garrot, R.A. and P.J. White

2007 Evaluating key uncertainties regarding road grooming and bison movements. September 25, 2007. Accessed online at http://www.cfc.umt.edu/cesu/NEWCESU/Assets/Individual%20Project%20Reports/NPS%20Projects/MSU/2007/0707Garrott_YELL_Bison%20and%20Road%20Grooming_Final.pdf

APPENDIX B: DRAFT AIR QUALITY MODELING REPORT SNOWMOBILE AND SNOWCOACH EMMISSIONS

DRAFT
AIR QUALITY MODELING REPORT
SNOWMOBILE AND SNOWCOACH EMISSIONS

WINTER USE PLAN
Environmental Impact Statement

YELLOWSTONE NATIONAL PARK

Prepared for

NATIONAL PARK SERVICE
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February 17, 2011

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***Note: Attachment B – J are available at the park's winter use website at http://www.nps.gov/yell/planyourvisit/winteruse.htm.**

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Winter Use Plan Environmental Impact Statement
Yellowstone National Park

1.0 Introduction and Background

In support of the Winter Use Plan Draft Environmental Impact Statement (DEIS) for Yellowstone National Park (Yellowstone), Air Resource Specialists, Inc. (ARS) completed an analysis of potential air quality impacts from snowmobile and snowcoach operations. This report analyzes potential air quality impacts for several alternatives utilizing air dispersion modeling and other accepted methods and models. Motorized over-snow vehicle (OSV) vehicle entry limits and other details for each of the alternatives were provided by NPS to ARS and are discussed in Section 3.0 and Attachment A.

This air quality study is part of the National Park Service's (NPS) efforts to complete a long-term analysis of the environmental impacts of winter use in the parks. At present, the NPS is operating under the current interim rule governing OSV use for a limited period. This rule is in effect through the winter of 2010-11.

Within Yellowstone, all snowmobiles must also meet Best Available Technology (BAT) requirements. The assessment of alternatives analyzed in this study is based on implementation of the associated entry limits and BAT requirements under consideration in the PDEIS, and beginning during the winter season of 2011-2012, which determines emissions factors.

For this air quality study of OSV emissions in Yellowstone, maximum predicted ambient concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter (PM_{10} and $PM_{2.5}$) were calculated using U.S. Environmental Protection Agency (EPA) approved air quality models. Impacts for each alternative were assessed with respect to the National Ambient Air Quality Standards (NAAQS). Modeling results were also compared to Prevention of Significant Deterioration (PSD) increments for particulate matter, and potential visibility impacts for each alternative were assessed. Winter-season emission estimates for criteria pollutants (CO, $PM_{,}$ and nitrogen oxides (NO_x)), hydrocarbons (HC), and hazardous air pollutants (HAPs) (benzene, 1,3 butadiene, formaldehyde, and acetaldehyde) were calculated. The methodology employed for this study is discussed in the following sections.

2.0 Regulatory Overview

Yellowstone is classified as a Class I area under the Federal Clean Air Act. This air quality classification is to provide protection against air quality degradation in national parks and wilderness areas. The Clean Air Act defines mandatory Class I areas as national parks over 6,000 acres, wilderness areas over 5,000 acres, and national memorial parks over 5,000 acres designated as of the date of the Act.

For this study, dispersion modeling was utilized to predict concentrations of CO, nitrogen dioxide (NO_2), and particulates (PM_{10} and $PM_{2.5}$) for a short-term localized basis at specific locations in the parks. These predicted concentrations were assessed with respect to the NAAQS, which are discussed below, to determine the potential for air quality impacts. In addition, an emission inventory was completed for the four (4) pollutants discussed below to assess regional OSV emissions during the winter season. Also, as a Class I area, an analysis of potential visibility impacts resulting from OSV emissions was conducted for four (4) areas. The methodology and results of this visibility analysis are presented in Section 8.0.

In 2002, EPA adopted new standards for new non-road engines, including snowmobiles, which were previously unregulated. As a significant source of air pollution, newly manufactured non-road engines will need to meet exhaust emission standards. For snowmobiles, the new HC and CO standards began to take effect for the 2006 model year, with a 50 percent phase-in requirement. Further details on these standards are provided below in Section 4.0.

2.1 Pollutants

Carbon monoxide (CO), a colorless, odorless, and poisonous gas, is produced in locations with motor vehicles, primarily by the incomplete combustion of gasoline and other fossil fuels. Health effects include impairment of the central nervous system, particularly on people with heart disease. CO also interferes with the transport of oxygen in the blood. In the vicinity of roadways, the majority, if not all, CO emissions are from motor vehicles. CO concentrations can vary greatly over relatively short distances. Elevated concentrations are usually limited to locations near crowded intersections, typically along heavily traveled and congested roadways.

Consequently, CO concentrations must be predicted on a localized or microscale basis. Elevated traffic volumes of snowmobiles and snowcoaches on certain park roadways could result in localized increases in CO levels. Therefore, the mobile source analysis evaluated CO concentrations from snowmobiles and snowcoaches at several modeling locations within the park.

Particulate matter (PM_{10} and $PM_{2.5}$) is emitted into the atmosphere from a variety of sources: industrial facilities, power plants, construction activity, etc. Gasoline powered vehicles typically do not produce any significant quantities of particulate emissions. Although less relevant to this study, diesel-powered vehicles, especially heavy trucks and buses, also emit particulates, and particulate concentrations may be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. The mobile source analysis evaluated particulate (PM_{10} and $PM_{2.5}$) concentrations from snowmobiles, snowcoaches, and diesel buses (for one alternative) at several modeling locations within the park.

Hydrocarbon (HC) emissions from motor vehicles can result from partially-burned fuel emitted through the tailpipe and from fuel evaporations from the crankcase, carburetor and gas tank. Hydrocarbons are also released from gasoline fuel vapor when vehicles are re-fueled at gas stations and when bulk storage tanks are refilled. When exposed to sunlight, hydrocarbons or volatile organic compounds (VOCs) contribute to formation of harmful ground level ozone, also known as smog. For the purposes of this study, hydrocarbons may also be expressed as VOCs, which include air toxins or hazardous air pollutants (HAPs). Within the park, these pollutants are of primary concern due to their potential serious health effects on NPS workers and visitors.

Air toxins or HAPs associated with motor vehicles also result from fuel evaporation and the fuel-burning process. These pollutants include a variety of chemicals known to cause cancer, poisoning and other ailments. The emission inventory completed for this study included hydrocarbon emissions as well as the following HAPs: benzene; 1,3 butadiene; formaldehyde; and acetaldehyde.

Nitrogen oxides (NO_x), are typically of principal concern because of their role as precursors in the formation of photochemical oxidants, such as ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. However, ozone is not an issue in the parks in the winter, although NO_x also contributes to atmospheric particles, and can cause respiratory problems and visibility impairment. NO_x emissions from mobile sources and the pollutants formed from NO_x can be transported over long distances, so they are generally examined on a regional basis and are assessed in the emission inventory component of this study. However, on a localized basis, the mobile source analysis evaluated NO_2 concentrations from snowmobiles and snowcoaches at several modeling locations within the park, for comparison to the 1-hour NAAQS.

2.2 Air Quality Standards

As required by the Clean Air Act and its amendments, the Environmental Protection Agency has established primary and secondary National Ambient Air Quality Standards (NAAQS) for six major air pollutants: CO, NO_2, ozone, particulate matter (PM_{10} and $PM_{2.5}$), SO_2, and lead. The NAAQS of primary concern for this analysis (CO, NO_2, PM_{10} and $PM_{2.5}$) are shown in Table 2-1.

The primary standards protect public health, and represent levels at which there are no known significant effects on human health. The secondary standards are intended to protect the nation’s welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. For CO, NO_2, PM_{10} and $PM_{2.5}$, the primary and secondary standards are the same.

Impacts for each alternative were assessed with respect to the NAAQS and relative to current and historical conditions. For Wyoming, Montana, and Idaho, the applicable state standards for CO, NO_2, and particulates are the same as the federal standards, with the exception of the 1-hour CO standard in Montana, which is 23 ppm.

Since Yellowstone is classified as Federal Class I area, PM_{10} increment comparison under PSD was also assessed. PSD increments are the maximum permitted increases in pollutant concentrations over baseline levels. For Class I areas, the PM_{10} PSD increments are 4 and 8 micrograms per cubic meter, for the annual and 24-hour

Table 2-1
National Ambient Air Quality Standards

Pollutant	**Primary**		**Secondary**	
	PPM	**Micrograms Per Cubic Meter**	**PPM**	**Micrograms Per Cubic Meter**
Carbon Monoxide (CO)			None	
Maximum 8-Hour Concentration[1]	9			
Maximum 1-Hour Concentration[1]	35			
Nitrogen Dioxide (NO_2)				
Annual Arithmetic Mean	0.053		Same as Primary	
Maximum 1-Hour Concentration[2]	0.100			
Respirable Particulates (PM_{10})				
Maximum 24-Hour Concentration[3]		150	Same as Primary	
Respirable Particulates ($PM_{2.5}$)				
Annual Arithmetic Mean[4]		15	Same as Primary	
Maximum 24-Hour Concentration[5]		35		

Notes:
[1] Not to be exceeded more than once per year.
[2] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).
[3] Not to be exceeded more than once per year on average over 3 years.
[4] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 ug/m^3.
[5] To attain this standard, the 3-year average of the 98^{th} percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 ug/m^3.
PPM = parts per million

Source: 40 CFR Part 50—National Primary and Secondary Ambient Air Quality Standards

averaging periods, respectively. Winter OSV emissions were considered increment consuming or contributing sources for this analysis. This study only assessed PSD increments for the 24-hour averaging period, since the sources of concern are only present during the winter season and an applicable annual average cannot be prepared. This assessment is a screening level approach and may indicate that a detailed analysis is required if concentrations are near the PM_{10} PSD increments. Furthermore, as the methodology employed in this study is a screening-level analysis, it is not intended for regulatory purposes and does not constitute a regulatory PSD increment consumption analysis.

2.3 Air Quality Monitoring

In recent years, ARS has been contracted by NPS to conduct winter air quality monitoring in Yellowstone near the Old Faithful geyser. Meteorological, gaseous, and particulate variables were monitored continuously.

The most recent monitored CO and $PM_{2.5}$ concentrations at these locations can be found in the *Data Transmittal Report for the Yellowstone National Park Winter Use Air*

Quality Study December 15, 2009 - March 15, 2010, Air Resource Specialists, July 2010. The highest CO 1- and 8-hour averages were 2.5 and 0.8 ppm, respectively, at the Old Faithful monitor for 2009-2010. These were well below the respective 1- and 8-hour CO NAAQS (35 and 9 ppm), Montana and Wyoming air quality standards. Similarly, the highest $PM_{2.5}$ 24-hour average in 2009-2010 was 5.1 micrograms per cubic meter at the Old Faithful monitor, which was well below the $PM_{2.5}$ NAAQS of 35 micrograms per cubic meter for the 24-hour averaging period.

Since monitoring began in 1998 for CO and in 2002 for $PM_{2.5}$ at Yellowstone, measured pollutant concentrations have steadily decreased, consistent with the decrease in number of snowmobile visits and the recent snowmobile technology emission requirements under the temporary plan. As documented in the *Winter Air Quality Study 2004-2005*, John D. Ray, Ph.D., NPS Air Resources Division, December 2005, at the West Entrance, the highest measured 8-hour average CO concentrations have gone from a near NAAQS exceedance of 8.9 ppm in the 1998-1999 winter season to 1.0 ppm in 2004-2005. At Old Faithful, the highest measured 8-hour average CO concentrations have declined from 1.2 ppm in the 2002-2003 winter season to 0.8 ppm in 2009-2010.

Similarly, the highest measured 24-hour average $PM_{2.5}$ concentrations at Old Faithful have declined from 32.1 micrograms per cubic meter in the 2002-2003 winter season to 5.1 micrograms per cubic meter in 2009-2010. These monitored maximum values demonstrate a distinct trend of improvement in winter pollutant concentrations in Yellowstone.

3.0 Alternatives

OSV entry limits and other details of the alternatives required as inputs for the air quality modeling and emission inventory were provided by the National Park Service (NPS). Descriptions of the six (6) alternatives are provided in Table 8, Summary of Alternative Elements, of Chapter 2 of the DEIS. In addition, distribution factors spreadsheets are included as Attachment A of this report. Although the methods used to develop the alternatives and general assumptions are discussed in detail in Chapter 2 of the DEIS, a summary of the development of modeling scenarios analyzed in this study follows.

The development of a model to distribute use within the park, based on the entrance limits specified under each alternative, is necessary in order to understand the impacts of the alternatives on park resources and values. These models, called travel factors, were developed in the past for the Temporary Winter Use EA and the 2007 Plan/EIS. The scenarios attempt to predict the total amount of daily winter recreational (motorized) traffic on each road segment within Yellowstone, by vehicle type.

The scenarios provide both a sense of how much snowmobile or snowcoach traffic one can expect in a day on each road segment within the parks and a comparison of the relative differences among the alternatives. This approach facilitates an understanding of the magnitude of differences of the environmental consequences of each alternative. The alternatives also provide fundamental air quality inputs to the modeling analyses.

4.0 Mobile Source Modeling

Estimates of maximum concentrations for pollutant averaging periods were prepared to compare with the national ambient air quality standards (which are based on 1- and 8-hour averages for CO concentrations, 1-hour averages for NO_2 concentrations, and 24-hour averages for particulate concentrations). The prediction of CO, NO_2, PM_{10} and $PM_{2.5}$ concentrations generated by over-snow vehicles takes into account emissions data, meteorological phenomena, vehicle traffic/travel conditions, and physical configurations (of roadways and staging areas). The mathematical formulations that comprise the dispersion and emission models attempt to simulate the extremely complex physical phenomenon as closely as possible. Although most dispersion models are typically conservative, especially under adverse meteorological conditions, the results of the modeling below compared with monitored concentrations show predicted concentrations within the reasonable in range of possibility, considering that all models must employ approximations of actual conditions.

The analysis employs a modeling approach widely used for evaluating air quality impacts throughout the country. This approach was coupled with a series of conservative assumptions for meteorology, traffic conditions, background concentration levels, etc. This combination results in conservative, yet realistic, estimates of expected pollutant concentrations and resulting potential impacts to air quality from the winter use vehicle emissions.

4.1 Dispersion Modeling

Air dispersion modeling analyses were conducted for emissions of CO, NO_2, PM_{10}, and $PM_{2.5}$ employing EPA's CAL3QHCR and AERMOD models. The models and modeling inputs, parameters, and assumptions, along with emission factors are discussed in detail below.

4.1.1 CAL3QHCR

At the entrance stations and roadways selected for study, analysis was performed using EPA's CAL3QHCR model (*Addendum to the User's Guide to CAL3QHC, A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections*, Office of Air Quality, Planning Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina). The CAL3QHCR model is an enhanced, but separate, version of CAL3QHC, which is based on the CALINE-3 line source dispersion model, with an additional algorithm for estimating vehicle queue lengths at signalized intersections. It is a Gaussian model utilized for predicting CO and PM concentrations along roadway segments and assumes the dispersion of pollutants downwind of a pollution source along a Gaussian (or normal) distribution. The pollution source is the emissions from motorized vehicles operating under free flow conditions. CAL3QHCR processes up to a year of meteorological data, vehicle emissions and traffic data using algorithms from CAL3QHC.

For this analysis, CAL3QHCR was run using the Tier II approach, with detailed data reflecting traffic conditions for each hour of the day and week. In addition to maximum hourly averages, CAL3QHCR is able to calculate running 8-hour averaged CO or 24-hour averaged PM concentrations. Similar to CAL3QHC, CAL3QHCR also provides the refinement of including the contribution of emissions from idling vehicles in the overall concentration. The model's queuing algorithm requires additional input for local traffic parameters, such as signal timing, and performs delay calculations to estimate the number of idling vehicles. In this study, locations with snowmobiles and snowcoaches stopping and idling were simulated with the characteristics of a signalized intersection for CAL3QHCR modeling.

4.1.2 AERMOD

Air pollutant concentrations from emissions at the snowmobile staging areas were evaluated with the AERMOD, developed by EPA. All modeling was performed using BEE-Line Software's BEEST suite, which integrates AERMOD (Version 09292), ISC, and related programs (AERMET, AERMAP, BPIP, etc.) into a graphical user interface. Since vehicles in the staging area are clustered (in the parking lots), the AERMOD model was selected, utilizing its area source dispersion modeling capabilities. All AERMOD technical options selected followed the *regulatory default option.*

Model inputs also specified rural conditions for dispersion coefficients and other variables. Terrain data for the park was obtained from United States Geological Survey (USGS) using The National Map Seamless Server website. Coordinates for the modeled area were input into a coordinate search in the National Map, in order to zoom into the site and 1-Arc Second National Elevation Dataset (NED) terrain files were downloaded as a Tagged Image File Format (TIFF) file for an area big enough to encompass the area to be modeled area.

4.2 Modeling Locations

Four (4) locations in the park were selected for air quality modeling because they were expected to generate the most elevated ambient air quality impacts associated with snowmobile and snowcoach operations, due to expected vehicle traffic levels. These locations (shown on Figure 4-1) are: Site 1, The West Entrance; Site 2, West Entrance to Madison Junction; Site 3, Canyon to Fishing Bridge; and Site 4, Old Faithful Staging Area. At the roadway modeling locations, multiple ground-level receptors (computer simulations of roadside locations) were modeled for CAL3QHCR along the approach and departure links at spaced intervals, outside of the mixing zone, the area of uniform emissions and turbulence. The receptor with the highest predicted concentration was used to represent each modeling site for each alternative.

Figure 4-1


Greater Yellowstone Area
Gardiner, MT
Cooke City, MT
North Entrance
Mammoth
Yellowstone National Park
Norris
West Yellowstone, MT
1
2
Canyon Village
3
West Entrance
Madison
Fishing Bridge
Lake Village
East Entrance
To Cody, WY
West Thumb
4
Old Faithful
Grant Village
Cave Falls
South Entrance
Flagg Ranch
John D. Rockefeller, Jr. Memorial Parkway
Jackson Lake
Grand Teton Nat'l Park
Moran Junction
Spatial Analysis Center
Yellowstone National Park
(307) 344-2246
February 18, 2003
N
Miles
0 5 10 15 20
Jackson, WY

Site 1: West Entrance

The West Entrance is a unique location for modeling as snowmobiles and snowcoaches approach the entrance station and then stop for a short time while entrance permits are checked. Vehicles experience delay and queuing traffic conditions. In addition, this location is in close proximity to West Yellowstone, MT. Modeling was performed based on an average "low speed" approach and departure and an average engine idle time of 30 seconds at each kiosk. The approach and departure paths of the vehicles were simulated by line sources or "links", up to 1,000 feet in each direction from the West Entrance. CAL3QHCR modeling was performed for this intersection-type location.

At the West Entrance modeling location, receptors were spaced oppositely in each direction out from a central receptor placed at the origin of the queuing links, with receptors placed in pairs on each side of the links. Receptors were placed 3 feet both east and west (lengthwise) of the central receptor; the next pair of receptors were placed 25 feet from the central receptor. The remaining receptors were placed at intervals of 25 feet out to a distance of 500 feet along the link.

Site 2: West Entrance to Madison

For many of the alternatives, this modeling location is expected to have the highest traffic volumes compared to other roadway segments in Yellowstone. This is expected to result in elevated emissions and associated impacts from snowmobile and snowcoach traffic. CAL3QHCR modeling was performed for the free-flow roadway segments of this location, employing emissions data for OSVs traveling at "cruise" speeds (see discussion of modes below). In winter, the speed limit for this road segment is 35 mph, whereas the limit is 45 mph for most of the park. As discussed above, vehicle traffic levels were based on the proposed entry limits in the winter use plan for each alternative.

For the West Entrance to Madison location, receptors were spaced along 2000 feet of the straight portions of the links. For the middle section of this modeling location, a gradual curve in the roadway geometry could result in potential overlapping emission contributions from roadway link segments at some modeling wind directions. Therefore, along these links, receptors were placed in pairs at intervals of 5, 25, 25, 50, 200, 200, 1500, and 1500 feet in both directions from the central receptors at the apex of the curve. As at the West Entrance, receptors were placed in pairs on each side of the links.

Site 3: Canyon to Fishing Bridge

This modeling location is expected to have moderate traffic volumes compared to other roadway segments in Yellowstone and is expected to result in lower emissions and associated impacts. CAL3QHCR modeling was performed for the free-flow roadway segments of this location, employing emissions data for snowmobiles and snowcoaches traveling at "cruise" speeds. As discussed above, vehicle traffic levels were based on the proposed entry limits for each alternative. For this location, receptors were placed in pairs on each side of the modeling roadway at intervals of 100 feet in both directions.

Site 4: Old Faithful Staging Area

The Old Faithful staging area was selected for modeling because of the concentration of emissions from snowmobiles and snowcoaches bringing visitors to the Old Faithful Geyser Basin and parking area. The primary contributor of emissions is the idling of engines after visitors enter and also prior to leaving these staging areas.

At the staging areas, emissions are clustered in distinct areas (the parking lots). Therefore, the AERMOD model was selected for area source modeling. Emissions at the staging area were calculated only for engine idling, which is assumed to be a total of five minutes on average for each vehicle, including during arrival and before departure. Engine emission calculations for the staging area did not explicitly include ingress and egress emissions from the vehicles, as these were included in the roadway segment emissions. It was conservatively assumed that all vehicles traveling from Madison and West Thumb to Old Faithful would enter the Old Faithful staging area, to maximize the number of vehicles included in the modeling for this site.

The Old Faithful staging area, including the three (3) main parking areas, was modeled as a 630 meter by 1037 meter rectangular area source for AERMOD modeling, aligned north-south. These dimensions were confirmed by Yellowstone staff.

At the staging areas, a grid network of receptors was modeled for AERMOD along the perimeters of the area sources representing idling vehicles. Receptors were arranged in rectangular grids surrounding the Old Faithful staging area. At Old Faithful, receptors were placed at 100 meter intervals around the perimeter of the staging area out to approximately 1.5 kilometers in both the east and west directions, and out to approximately 2.0 kilometers in both the north and south directions.

4.3 Vehicle Emissions Data

To predict ambient concentrations of pollutants generated by vehicular traffic, emissions from vehicle exhaust systems must be estimated accurately. This analysis focuses primarily on emissions associated with visitor use of OSVs within the park, however, administrative vehicles are also included in the modeling. In addition, alternative 4 would also provide guided visitor access by on-road vehicles, by plowing Yellowstone's west-side roadways.

Emissions data and vehicle usage data (discussed below) were used for atmospheric dispersion modeling analyses to calculate the ambient levels of CO, NO_2, PM_{10} and $PM_{2.5}$ at four (4) locations within the park, for the alternatives. Emissions data will also be utilized to predict the total winter-season emissions of CO, PM, NO_x, HC, and HAPs from the operation of OSVs in the park. The data to be employed for this analysis were obtained from past air quality and emissions testing, research studies, as well as from vehicle manufacturers. Snowmobile laboratory test data utilized may not reflect actual operating conditions in Yellowstone, as high altitude and low winter temperatures in the parks are likely to decrease overall snowmobile engine performance and increase relative emissions. However, this data may be the best available.

For most alternatives, the analysis assumed that all snowmobiles are 4-stroke engines meeting NPS Best Available Technology (BAT) requirements. Current BAT for snowmobiles operating in Yellowstone has been established for CO and HC emissions, at less than 120 and 15 grams per kilowatt hour, respectively. BAT requirements are shown in Table 4-1.

Table 4-1
Snowmobile BAT Requirements and EPA Standards

	Emission Requirement or Standard		**Phase-in***
	Hydrocarbons (HC) (g/KW-hr)	**Carbon Monoxide (CO) (g/KW-hr)**	
NPS BAT	15	120	-
EPA Emission Standards			
Model Year			
2006	100	275	50%
2007-2009	100	275	100%
2010	75	275	100%
2012	75	200	100%

Note:
* Percent of newly manufactured sleds for the model year that must meet the applicable requirement.

In addition, EPA adopted new standards for new non-road engines in 2002. For snowmobiles, the new standards will begin to take effect for the 2006 model year, with a 50 percent phase-in requirement. These standards and the corresponding implementation years are also provided in Table 4-1.

Composite emission factors for each alternative were calculated by weighting the snowmobile and snowcoach emission factors appropriate for each particular alternative according to usage levels of each vehicle type. These composite emission factors (weighted averages) were inputted to the CAL3QHCR modeling.

4.3.1 4-Stroke Snowmobile Emission Factors

4-stroke snowmobile emission factors for CO, NO_x and HC used this analysis were calculated based on testing performed in the University of Denver's *Portable Emission Measurements of Snowmobiles and Snowcoaches in Yellowstone National Park*, Gary A. Bishop, Ryan Stadtmuller, and Donald H. Stedman, January 2007. This study collected in-use measurements of emissions from two snowmobiles (2006 Arctic Cat T660 Touring and a 2004 Ski Doo Legend GT) operating in Yellowstone during January and February of 2006, using a remote sensing device.

Particulate emission factors for 4-stroke snowmobiles were not measured in the above study, and were determined from manufacturers' EPA certification modal emission testing and engine performance results, following standard EPA test procedures, for the

BAT-approved snowmobile engines of two different manufacturers (Arctic Cat T660 Touring and Polaris Frontier), in SwRI's *Laboratory Testing of Snowmobile Emissions*, Lela and White, July 2002. The average 4-stroke snowmobile emission factors based on these data are shown in Table 4-2.

Table 4-2
Snowmobile Emission Factors

	PM			CO			HC			NO_X		
	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)
BAT 4- Stroke snowmobiles	0.49	0.065	0.031	201.6	37.0	14.0	7.7	1.7	1.0	1.2	4.0	4.5

4.3.2 Snowcoach Emission Factors

Snowcoach emission factors for this analysis were also obtained from the University of Denver's *Portable Emission Measurements of Snowmobiles and Snowcoaches in Yellowstone National Park*, reference in the section above. This study measured emissions from ten (10) snowcoaches operating in Yellowstone during January and February of 2006. This data provides the most comprehensive collection of emissions data from in-use snowcoaches to date. These studies, along with others, show that the vehicle operating conditions (altitude, temperature, terrain, vehicle operator, etc.) can greatly affect snowcoach emission factors.

A summary of the idle and traveling (low speeds of less than 15 mph and cruise speeds of 15 to 35 mph) emissions is shown in Table 4-3, representing gas and diesel BAT emissions, along the "current conditions" non-BAT gas emission for modeling purposes.

All alternatives assume implementation of a snowcoach BAT requirement based on EPA Tier 2 light-duty vehicle emission standards. Separate requirements would also need to be developed for heavy-duty/diesel snowcoaches, possibly based on EPA's Heavy-duty Diesel regulation. Future snowcoach BAT requirements are likely to only require the vehicles employ the related technologies associated with these EPA emission standards, rather than meet the actual standards themselves, as snowcoaches operate in conditions very different from their on-road counterparts.

For modeling purposes, gas snowcoach BAT emission factors were determined by the average of emission factors of the port fuel-injected gas snowcoaches tested in the University of Denver study. "Current conditions" non-BAT gas snowcoach emission factors were determined by a 50/50 average of the one carbureted gas snowcoach tested and the average of the newer port fuel-injected gas snowcoaches. Since only one diesel snowcoach was tested, its emission factors represented both diesel BAT and "current conditions" for diesel snowcoach BAT. All alternatives assume a 50/50 split of gas to diesel BAT snowcoaches for modeling purposes, except for alternative 5a, which assumes an 83/17 split of "current conditions" gas snowcoaches to diesel snowcoaches. Snowcoach emission calculations are provided in Attachment C.

Table 4-3
Snowcoach Emission Factors for Modeling

	PM			CO			HC			NO_X		
	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)
BAT Gas Snowcoaches	0.07	0.03	0.03	42.4	27.2	107.4	11.2	1.3	1.4	2.1	3.8	5.8
BAT Diesel Snowcoaches*	0.11	0.40	0.30	14.0	24.0	5.7	4.9	1.4	0.8	43.2	50.5	30.0
Current Condition Gas Snowcoaches**	0.07	0.03	0.03	741.2	133.6	208.7	29.0	3.7	2.3	1.2	19.4	20.9

Note:
Gas snowcoach PM and diesel snowcoach HC emissions from MOBILE6.
* Diesel emissions measured only from NPS Bus.
**Gas non-carbureted (port fuel-injected) snowcoaches averaged 50/50 with carbureted snowcoach tested.
Source: *Portable Emission Measurements of Snowmobiles and Snowcoaches in Yellowstone National Park*, Bishop, Stadtmuller, and Stedman, University of Denver.

4.3.3 On-road Vehicle Emission Factors

For the analysis of Alternative 4, which includes plowing of Yellowstone's west-side roads, on-road (wheeled) vehicular emissions (CO, PM, NO_x and HC) were necessary. Emission factor estimates were computed using the EPA-developed Mobile Source Emissions Model (MOBILE6) for up to five (5) classes of motor vehicles: light-duty, gasoline-powered trucks (LDGT3 and LDGT4); heavy-duty, gasoline-powered trucks (HDGV); heavy-duty, diesel vehicles (HDDV); gasoline buses (HDGB); and diesel buses (HDDBT). The types of on-road vehicles in the fleet for this alternative would be limited since all vehicle entry would be commercially guided. The vehicle mix for this analysis was estimated to be one third of each of the following vehicle types: suburban/large passenger truck or similar; 12-15 person vans/small buses or similar light-duty trucks; and large, heavy-duty buses (30-40 feet in length).

MOBILE6 emission factors were prepared to account for high altitude, no Inspection and Maintenance (I&M) programs, conventional gasoline, and current winter inputs such as temperature (0° to 30° Fahrenheit), fuel parameters, etc. (e.g., fuel volatility). NPS provided vehicle classification data, and national default vehicle age distributions were used. Emission factors for on-road vehicles were determined for idle conditions and the same low and cruise speeds as modeled for OSVs, representing slower winter conditions traveling speeds.

Emission estimates typically account for three possible vehicle operating conditions: cold vehicle operation, hot start operation, and hot stabilized operation. It is important to distinguish between these three operating categories, because vehicles emit pollutants at different rates depending on whether they are cold or warmed up. Since local data are not available, MOBILE6 defaults were employed for operating conditions. Composite emission factors for modeling on-road vehicles were determined based on the vehicle mix estimated above and are shown in Table 4-4. MOBILE6 input and output files are included as Attachment D. In addition, particulate emission factors for Alternative 4 on-road vehicle travel on paved roads (plowed) were determined using EPA's *AP-42 Section 13.2.1, Paved Roads*, January 2011. These calculations are included in Attachment H.

Table 4-4
MOBILE6 Emission Factors for On-road Vehicles
(Alternative 4 only)

	PM_{10}			CO			HC			NO_X		
	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)	Idle (g/hr)	Low Speed mph (g/mi)	Cruise Speed mph (g/mi)
On-Road Vehicles (Composite Mix)	0.54	0.065	0.065	116.3	25.8	14.7	8.3	1.49	0.88	13.5	4.13	2.96

Note:
Vehicle mix / VMT fractions: 34% LDT4, 11% CLASS 2b HDV, 11% CLASS 3 HDV, 11% CLASS 4 HDV, 33% BUS
PM_{10} emissions include tire and brake wear.
Source: MOBILE6.2

4.4 Traffic Activity Data

Traffic data for the air quality analysis were derived from snowmobile and snowcoach entry limits and other information for each alternative provided to ARS by NPS (Appendices A and J). Refined microscale, or localized, dispersion modeling analysis was conducted for the each hour of the day, at each of the four modeling locations, to most accurately assess the potential for significant air quality impacts.

To determine hourly vehicle inputs for the modeling locations, hourly distribution data of OSVs collected by the park was used together with the travel factor spreadsheets previously discussed in Section 3.0 to determine hourly traffic activity and emission factors for each alternative. The modeling assumed two lanes open in the morning, with about two thirds of daily entries going to the southernmost booth and third going to the middle (north) booth; the northernmost booth is currently unused in winter.

4.5 Meteorological Conditions

Following EPA methodology and guidance from NPS, on-site meteorological data from Yellowstone's Water Tank site IMPROVE monitoring site, along with concurrent upper air data from Riverton, Wyoming Airport, were processed with AERMET for use in the AERMOD modeling. In addition, the same data were processed with the Meteorological Processor for Regulatory Models (MPRM) for use in CAL3QHCR modeling. The meteorological data sets employed for the modeling include five (5) individual full years of data for 2003 to 2007. However, both AERMOD and CAL3QHCR modeling were completed selecting only the January 1^{st} thru March 31^{st} and December 15^{th} thru December 31^{st} periods of each modeling year, as meteorological conditions for these periods would most closely represent the park's winter use season.

4.6 Background Concentrations

Background concentrations are those pollutant concentrations not directly accounted for by the modeling analysis. Background concentrations must be added to modeling results to obtain total pollutant concentrations at prediction sites. Background concentrations can typically be attributed to local sources, long-range transport and natural sources. For this analysis, background levels include smoke (from wood-burning stoves and fireplaces) and other emissions from West Yellowstone. Background concentrations for this analysis were estimated considering the guidelines provided in *Guideline on Air Quality Models, Appendix W to 40 CFR part 51,* Federal Register, November 9, 2005.

Recent data collected at West Yellowstone and Old Faithful monitors provided background concentration estimates of a 1-hour average CO background of 0.17 ppm, and an 8-hour average CO background of 0.15 ppm, based on overnight monitoring data (John D. Ray, Atmospheric Chemist, NPS Air Resources Division, Denver, Colorado, July 2006 personal communication), so that emissions from the daytime OSVs modeled in this analysis would not be "double-counted".

The 24-hour average PM_{10} background concentration was determined from the IMPROVE network aerosol data (gravimetric mass average of 2002-04 annual mean values) and is 4.2 micrograms per cubic meter. The 24-hour average $PM_{2.5}$ background concentration was determined from *$PM_{2.5}$ Winter Air Quality in Yellowstone National Park*, John D. Ray, Ph.D., National Park Service, and is 1.4 micrograms per cubic meter. Consistent with EPA guidance, IMPROVE data provide representative background particulate levels that are not directly affected by winter OSVs emissions, as the monitoring station is located near Lake Village. All background concentrations used in this analysis are shown in Table 4-5.

5.0 Dispersion Modeling Results

As noted previously, receptors were placed at multiple locations at each of four modeling locations. The receptor with the highest predicted concentration was used to represent each modeling site for each of the alternatives. CO, NO_2, and PM concentrations were calculated for each location, for each alternative.

For all modeling results, the values shown are the highest predicted concentrations for each receptor location and include background levels. CO concentrations under each alternative were determined using the methodology previously described.

Table 4-5
Background Concentrations

CO (ppm)	
1-hour	**8-hour**
0.17	0.15
24-hour Particulates (ug/m^3)	
PM_{10}	**$PM_{2.5}$**
4.2	1.4

Note:
CO backgrounds estimated from average overnight values from John D. Ray (Atmospheric Chemist, NPS Air Resources Division, Denver Colorado), July 2006, personal communication.
Particulate backgrounds based on IMPROVE network aerosol data.

Tables 5-1 and 5-2 show the maximum predicted 1- and 8-hour average CO concentrations for each of the alternatives at the analysis sites. The modeling results indicate that winter use vehicle emissions would not result in any exceedances of the CO NAAQS, or the Montana or Wyoming ambient air quality standards, under any of the alternatives.

Table 5-3 shows the maximum predicted 1-hour average NO_2 concentrations for each of the alternatives at the analysis sites. Based on guidance in the *Guideline on Air Quality Models, Appendix W to 40 CFR part 51*, and discussion with NPS, a ratio of 0.78 was used to determine the NO_2 fraction of NO_x. The modeling results indicate that winter use vehicle emissions would not result in any exceedances of the NO_2 NAAQS, or the Montana or Wyoming ambient air quality standards, under any of the alternatives.

Table 5-4 shows the maximum predicted 24-hour $PM_{2.5}$ concentrations for each of the alternatives at the analysis sites. The modeling results indicate that no winter use vehicle emissions from any of the alternatives would result in exceedances of the 24-hour $PM_{2.5}$ NAAQS, or the Montana or Wyoming ambient air quality standards. In addition, it should be noted that all predicted $PM_{2.5}$ concentrations for this analysis are conservative, as most available emission factors utilized for vehicles assumed total particulates, or PM_{10} as all $PM_{2.5}$. However, the modeling results indicate there would not be any exceedances of the 24-hour PM_{10} NAAQS, or the Montana or Wyoming ambient air quality standards, under any of the alternatives.

Since Yellowstone is a Class I area, PM_{10} increment consumption under PSD was also assessed. For Class I areas, the PM_{10} PSD increment is 8 micrograms per cubic meter, for the 24-hour averaging period, which EPA has determined is the small "allowable" incremental increase for PM_{10} in these areas. This increment is evaluated in reference to the previously established (by Montana and Wyoming) baseline date of 1979 for Yellowstone (*Air Quality Concerns Related to Snowmobile Usage in National Parks*, National Park Service Air Resources Division, February 2000), which was used to determine baseline concentrations. This study employed only a screening level approach in comparing predicted PM_{10} increments (no background contribution) with estimated 1979 baseline concentrations to determine the increment for the alternatives.

Table 5-1
Maximum Predicted 1-hour CO Concentrations
(parts per million)

Scenario	Description	Site 1: West Entrance 1-hour (ppm)	Site 2: West Entrance to Madison 1-hour (ppm)	Site 3: Canyon to Fishing Bridge 1-hour (ppm)	Site 4: Old Faithful Staging Area 1-hour (ppm)
Alternative 2	2008 Plan Limits	1.0	0.4	0.3	0.3
Alternative 3	2004 Plan Limits	1.8	0.7	0.3	0.4
Alternative 4	Mixed Use	0.3	0.3	0.2	0.2
Alternative 5a START	Transition to BAT Snowcoaches Only	1.2	0.5	0.3	0.4
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	0.2	0.3	0.3	0.2
Alternative 6	Implement Variable Management	1.5	0.4	0.3	0.4
Alternative 7a	Provide Variety of Use Levels - Max	1.5	0.4	0.3	0.3
Alternative 7b	Provide Variety of Use Levels - Mid	0.7	0.3	0.3	0.3
Alternative 7c	Provide Variety of Use Levels - Low	0.4	0.3	0.2	0.2

Note:
NAAQS for CO are 35 and 9 parts per million (ppm), for the 1-hour and 8-hour averaging periods, respectively.

Table 5-2
Maximum Predicted 8-hour CO Concentrations
(parts per million)

Scenario	Description	Site 1: West Entrance 8-hour (ppm)	Site 2: West Entrance to Madison 8-hour (ppm)	Site 3: Canyon to Fishing Bridge 8-hour (ppm)	Site 4: Old Faithful Staging Area 8-hour (ppm)
Alternative 2	2008 Plan Limits	0.4	0.2	0.3	0.2
Alternative 3	2004 Plan Limits	0.6	0.3	0.2	0.2
Alternative 4	Mixed Use	0.2	0.2	0.2	0.2
Alternative 5a START	Transition to BAT Snowcoaches Only	0.5	0.3	0.2	0.2
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	0.2	0.2	0.2	0.2
Alternative 6	Implement Variable Management	0.5	0.3	0.2	0.2
Alternative 7a	Provide Variety of Use Levels - Max	0.4	0.2	0.2	0.2
Alternative 7b	Provide Variety of Use Levels - Mid	0.3	0.2	0.2	0.2
Alternative 7c	Provide Variety of Use Levels - Low	0.2	0.2	0.2	0.2

Note:
NAAQS for CO are 35 and 9 parts per million (ppm), for the 1-hour and 8-hour averaging periods, respectively.

Table 5-3
Maximum Predicted 1-hour NO_2 Concentrations
(parts per billion)

Scenario	Description	Site 1: West Entrance 1-hour (ppb)	Site 2: West Entrance to Madison 1-hour (ppb)	Site 3: Canyon to Fishing Bridge 1-hour (ppb)	Site 4: Old Faithful Staging Area 1-hour (ppb)
Alternative 2	2008 Plan Limits	27	17	16	1
Alternative 3	2004 Plan Limits	27	30	17	1
Alternative 4	Mixed Use	10	5	7	2
Alternative 5a START	Transition to BAT Snowcoaches Only	20	18	11	1
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	19	10	10	1
Alternative 6	Implement Variable Management	32	24	14	1
Alternative 7a	Provide Variety of Use Levels - Max	32	18	11	1
Alternative 7b	Provide Variety of Use Levels - Mid	29	12	8	1
Alternative 7c	Provide Variety of Use Levels - Low	8	7	5	1

Note:
NAAQS for NO_2 is 100 parts per billion (ppb), for the 1-hour averaging period.

Table 5-4
Maximum Predicted 24-hour $PM_{2.5}$ Concentrations
(micrograms per cubic meter)

Scenario	Description	Site 1: West Entrance 24-hour (ug/m^3)	Site 2: West Entrance to Madison 24-hour (ug/m^3)	Site 3: Canyon to Fishing Bridge 24-hour (ug/m^3)	Site 4: Old Faithful Staging Area 24-hour (ug/m^3)
Alternative 2	2008 Plan Limits	1.9	1.5	1.4	1.5
Alternative 3	2004 Plan Limits	2.5	1.5	1.5	1.5
Alternative 4	Mixed Use	2.1	2.4	1.4	1.5
Alternative 5a START	Transition to BAT Snowcoaches Only	1.9	1.4	1.4	1.5
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	1.4	1.5	1.4	1.4
Alternative 6	Implement Variable Management	2.2	1.5	1.4	1.5
Alternative 7a	Provide Variety of Use Levels - Max	1.9	1.5	1.4	1.5
Alternative 7b	Provide Variety of Use Levels - Mid	1.6	1.4	1.4	1.4
Alternative 7c	Provide Variety of Use Levels - Low	1.5	1.4	1.4	1.4

Note:
NAAQS for PM_{10} is 150 µg/m^3 and for $PM_{2.5}$ is 35 µg/m3, for the 24-hour averaging period.

Although snowmobile (and snowcoach) traffic in the parks has increased since 1979, it was expected that the 4-stroke BAT snowmobiles required by the alternatives would generally result in a net decrease in 24-hour PM_{10} levels compared to the established baseline date. The 1979 baseline levels were estimated from adjusting 1999 Historical Conditions Scenario modeled PM_{10} levels (from the 2007 Plan/EIS) based on the maximum daily snowmobile levels (from Yellowstone entry records) of the two years. As the methodology employed in this study is a screening-level analysis, it is not intended for regulatory purposes and does not constitute a regulatory PSD increment consumption analysis. Typically, detailed analysis would be required if concentrations are near or "consume" allowable Class I PM_{10} PSD increment. Calculations for estimating baseline levels are included as Attachment G.

The predicted 24-hour PM_{10} increment consumption values based on the previously described particulate modeling are shown in Table 5-5 for each of the alternatives. There is no 24-hour PM_{10} increment consumption for any of the modeling locations compared to the baseline date.

Table 5-5
24-hour PM_{10} PSD Increment Consumption

		Site 1: West Entrance	Site 2: West Entrance to Madison	Site 3: Canyon to Fishing Bridge	Site 4: Old Faithful Staging Area
Scenario	Description	24-hour (ug/m^3)	24-hour (ug/m^3)	24-hour (ug/m^3)	24-hour (ug/m^3)
Alternative 2	2008 Plan Limits	0.5	0.1	0.0	0.1
Alternative 3	2004 Plan Limits	1.1	0.1	0.1	0.1
Alternative 4	Mixed Use	0.7	1.0	0.0	0.1
Alternative 5a START	Transition to BAT Snowcoaches Only	0.5	0.0	0.0	0.1
Alternative 5B FINAL	Transition to BAT Snowcoaches Only	0.0	0.1	0.0	0.0
Alternative 6	Implement Variable Management	0.8	0.1	0.0	0.1
Alternative 7a	Provide Variety of Use Levels - Max	0.5	0.1	0.0	0.1
Alternative 7b	Provide Variety of Use Levels - Mid	0.2	0.0	0.0	0.0
Alternative 7c	Provide Variety of Use Levels - Low	0.1	0.0	0.0	0.0
1999 Historical	Historical Unregulated Scenario	191.5	40.2	5.9	3.8
PSD Baseline Year	1979 Historical Conditions	42.5	8.9	1.1	0.7

Note:
Baseline Year concentrations are based on the ratio of 1979 to 1999 snowmobile levels at the modeling locations.
Class I PSD Increment for 24-hour average PM_{10} is 8 $\mu g/m^3$
As the methodology employed in this study is a screening-level analysis, it is not intended for regulatory purposes and does not constitute a regulatory PSD increment consumption analysis.

6.0 Emissions Inventory

In addition to the dispersion modeling analysis for determining potential short-term CO and particulate concentrations, an emissions inventory of snowmobiles and snowcoaches operating in Yellowstone in tons per winter season was completed for each alternative, based on vehicle entry limits and other information provided (Attachment A).

Emissions were calculated using travel estimates of OSV and on-road vehicles used on Yellowstone roadways, the roadway lengths, and modes of operation of the vehicles. Emission factor data previously discussed in Section 4.3 were combined with daily vehicle traffic levels for each roadway segment, for each alternative, to determine total park-wide emissions for each pollutant. The winter season was defined as a 90-day period that typically runs from about mid-December to early March.

Estimates were prepared for criteria pollutants (CO, PM, and NO_x) and HC. The total maximum potential winter season emissions due to operations of snowmobiles and snowcoaches in the parks in tons per winter season are shown for each alternative in Table 6-1. Detailed emission inventory calculations are included as Attachment H. An emissions inventory for HAPs was also completed for each alternative and is discussed in the next section. Table 6-2 shows the contribution by vehicle type by percentage of the total season emissions for the alternatives.

7.0 Hazardous Air Pollutant (HAP) Emissions

Emissions of HAPs (benzene, 1,3 butadiene, formaldehyde, and acetaldehyde) occur in OSVs emissions and are associated with incomplete fuel combustion. An emission inventory for these HAPs was completed based on HC speciation estimates and the total winter season HC emissions previously determined. For snowmobiles, HAPs emissions were estimated as a fraction of measured HC emissions from 4-stroke snowmobiles based on data reported in SwRI's *Laboratory Testing of Snowmobile Emissions*, Lela and White, July 2002. HAPs classified as air toxics are presented in Table 7-1 as a percentage of the total HC mass, for snowmobiles.

HAPs emissions from on-road vehicles were determined using MOBILE6. HAPs emissions from snowcoaches were calculated using the percentages of the total HC mass derived from MOBILE6, based on the on-road vehicle types that are converted to snowcoaches and the snowcoach HC emissions data from the University of Denver testing. The snowcoach vehicle mix was approximated by the following MOBILE6 vehicle mix fractions: 50 percent light-duty trucks (LDT4), 17 percent CLASS 2b heavy-duty vehicles (HDV), 17 percent CLASS 3 HDV, and 16 percent CLASS 4 HDV. A diesel fraction of five (5) percent for all vehicle classes was assumed. HAP emissions as a percentage of total HC mass, for snowcoaches and on-road vehicles are presented in Table 7-2. Using the methodology described, total winter season mobile source emissions of HAPs were estimated and are summarized in Table 7-3.

Table 6-1
Park-wide Total Winter Season Mobile Source Emissions (Pounds per Day / Tons per Year)

Scenario	Description	CO		HC		NOx		PM	
		lb/day	tpy	lb/day	tpy	lb/day	tpy	lb/day	tpy
Alternative 2	2008 Plan Limits	1,952	88	93	4.16	619	28	5	0.2
Alternative 3	2004 Plan Limits	2,992	135	166	7.48	947	43	7	0.3
Alternative 4	Mixed Use	1,177	53	64	2.90	345	16	201	9.0
Alternative 5a START	Transition to BAT Snowcoaches Only	3,809	171	108	4.85	690	31	4	0.2
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	1,540	69	41	1.86	489	22	4	0.2
Alternative 6	Implement Variable Management	1,663	75	88	3.94	527	24	4	0.2
Alternative 7*	Provide Variety of Use Levels	1,998	73	95	3.53	633	23	5	0.2

Note:
All Alternatives assume snowmobile and snowcoach BAT, except Alternative 5a Start, which assumes only snowmobile BAT.
* Daily estimates (lb/day) for Alternative 7 are based on the maximum use levels for a given day.

Table 6-2
Percent Contribution by Vehicle Type to Total Scenario Emissions

Scenario	Description	CO			HC			NOx			PM		
		Snowmobile	Snowcoach	On-road Vehicle	Snowmobile	Snowcoach	On-road Vehicle	Snowmobile	Snowcoach	On-road Vehicle	Snowmobile	Snowcoach	On-road Vehicle
Alternative 2	2008 Plan Limits	54%	46%	na	81%	19%	na	54%	46%	na	48%	52%	na
Alternative 3	2004 Plan Limits	70%	30%	na	90%	10%	na	70%	30%	na	64%	36%	na
Alternative 4	Mixed Use	43%	36%	21%	56%	13%	31%	47%	39%	14%	0.6%	0.6%	98.8%
Alternative 5a START	Transition to BAT Snowcoaches Only	28%	72%	na	70%	30%	na	49%	51%	na	67%	33%	na
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	15%	85%	na	39%	61%	na	15%	85%	na	11%	89%	na
Alternative 6	Implement Variable Management	65%	35%	na	87%	13%	na	65%	35%	na	58%	42%	na
Alternative 7	Provide Variety of Use Levels	56%	44%	na	82%	18%	na	56%	44%	na	56%	44%	na

Table 7-1
Snowmobile HC Speciation Data

	4-stroke Snowmobiles (percent of HC)
Benzene	2.60 %
1-3 Butadiene	0.00 %
Formaldehyde	2.81 %
Acetaldehyde	1.08 %

Table 7-2
Snowcoach and On-road Vehicle HC Speciation

	Snowcoach (percent of HC)	On-road Vehicles (percent of HC)
Benzene	3.19 %	3.26 %
1-3 Butadiene	0.60 %	0.64 %
Formaldehyde	2.63 %	3.54 %
Acetaldehyde	0.85 %	1.32 %

Table 7-3
Park-wide Total Winter Season Mobile Sources HAPs Emissions
(Tons per Year)

Scenario	Description	Benzene (tpy)	1-3 Butadiene (tpy)	Formaldehyde (tpy)	Acetaldehyde (tpy)
Alternative 2	2008 Plan Limits	0.11	0.00	0.12	0.04
Alternative 3	2004 Plan Limits	0.20	0.00	0.21	0.08
Alternative 4	Mixed Use	0.08	0.01	0.09	0.03
Alternative 5a START	Transition to BAT Snowcoaches Only	0.14	0.01	0.12	0.04
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	0.06	0.01	0.05	0.02
Alternative 6	Implement Variable Management	0.11	0.00	0.11	0.04
Alternative 7	Provide Variety of Use Levels	0.10	0.00	0.10	0.04

Note:
4-stroke snowmobile HAPs estimated as a fraction of measured HC emissions based on data reported in SwRI's *Laboratory Testing of Snowmobile Emissions*, Lela and White, July 2002.
Snowcoach and on-road vehicle HAPs estimated as a fraction of HC emissions based on MOBILE6 modeling of HC and air toxics emission factors for light- and heavy-duty vehicles.

8.0 Visibility

Yellowstone and Grand Teton are classified as Class I areas under the Federal Clean Air Act. As required by the visibility protection provision of the Clean Air Act, additional procedural requirements apply when a proposed source has the potential to impair visibility in a Class I area (40 CFR 52.27 (d)). Therefore, an analysis of anticipated visibility impacts resulting from on-snow vehicle emissions was conducted following procedures in the *Workbook for Plume Visual Impact Screening and Analysis*, EPA-450/4-88-015, 1992. The EPA model VISCREEN incorporates the methodology and was used to conduct a Level 1 screening analysis of potential visibility impacts. Virtual point source methods were applied to adapt procedures originally designed for assessing plume impacts resulting from industrial stacks to the line and area sources modeled at the four locations in this study.

For the visibility analysis, a winter Yellowstone value of 240 kilometers was assumed for the background visual range. This was converted from the reference level light-extinction coefficient for Yellowstone (winter) provided in Appendix 2.B of the *Federal Land Managers' Air Quality Related Values Workgroup (FLAG), Phase I Report*, U.S Forest Service, NPS, and U.S. Fish and Wildlife Service (December 2000) using conversion equation 1 in Appendix 2.A of the report.

The results of the VISCREEN modeling are shown in Table 8-1. There were no potential localized, perceptible, visibility impairments predicted for any of the alternatives at the screening locations. Visibility modeling parameters and modeling input and output files are included as Attachment I.

Table 8-1
Visibility Impairment

		Screening Criteria Exceedance			
Scenario	**Description**	**Site 1: West Entrance**	**Site 2: West Entrance to Madison**	**Site 3: Canyon to Fishing Bridge**	**Site 4: Old Faithful Staging Area**
Alternative 2	2008 Plan Limits	No	No	No	No
Alternative 3	2004 Plan Limits	No	No	No	No
Alternative 4	Mixed Use	No	No	No	No
Alternative 5a START	Transition to BAT Snowcoaches Only	No	No	No	No
Alternative 5b FINAL	Transition to BAT Snowcoaches Only	No	No	No	No
Alternative 6	Implement Variable Management	No	No	No	No
Alternative 7a	Provide Variety of Use Levels - Max	No	No	No	No
Alternative 7b	Provide Variety of Use Levels - Mid	No	No	No	No
Alternative 7c	Provide Variety of Use Levels - Low	No	No	No	No

9.0 Summary and Conclusions

In support of the Winter Use Plan DEIS for Yellowstone, this report analyzed potential air quality impacts from snowmobile and snowcoach operations for several alternatives, utilizing air dispersion modeling and other accepted methods and models. For all alternatives, snowmobiles entering Yellowstone must be BAT machines. In addition, all alternatives assume implementation of a snowcoach BAT.

For each alternative, maximum predicted ambient concentrations of CO, NO_2 and $PM_{2.5}$ were calculated using dispersion modeling and impacts were assessed with respect to the NAAQS. Modeling results were also compared to PSD increments for particulate matter. Winter-season emission estimates in tons per year were calculated for CO, PM, NO_x, HC, and HAPs, and potential visibility impacts for each alternative were also assessed.

The results of the air quality modeling revealed that none of the alternatives would be likely to exceed the CO, NO_2, and $PM_{2.5}$ NAAQS, or the Montana or Wyoming ambient air quality standards. With respect to both predicted pollutant concentrations and total winter-season emissions, compared to current levels, all of the alternatives would generally improve pollutant concentrations as a result of BAT requirements and daily entry limits, with the exception of alternative 4, which results in slightly higher predicted localized particulate emissions from the modeled wheeled vehicle travel contribution of resuspended particulate emissions under winter conditions. However, particulate levels for this alternative still would be significantly below all relevant standards, and in addition, the prediction of resuspended particulate emissions is based on conservative assumptions standardized methodologies that may not fully represent actual conditions in the park.

In addition, the results of the Class I PSD assessment shows that 24-hour PM_{10} increment consumption for each of the alternatives at all modeling locations would be lower than the PSD increment of 8 micrograms per cubic meter. However, as the methodology employed in this study is a screening-level analysis, it is not intended for regulatory purposes and does not constitute a regulatory PSD increment consumption analysis

DRAFT
AIR QUALITY MODELING REPORT
SNOWMOBILE AND SNOWCOACH EMISSIONS

ATTACHMENTS

YELLOWSTONE NATIONAL PARK

Prepared for

NATIONAL PARK SERVICE
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February 17, 2011

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***Note: Attachment B – J are available at the park's winter use website at http://www.nps.gov/yell/planyourvisit/winteruse.htm.**

ATTACHMENT A
MOTORIZED OVERSNOW VEHICLE ALTERNATIVES

2011 DEIS Alternative 2 - 318 / 78

Snowmobiles	West Entrance 160		South Entrance 114		East Entrance 20		North Entrance 12		Old Faithful 12		Total 318
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	8	0.03	3.42	0.1	2	1.8	21.6	0.3	3.6	38.62
West Entrance to Madison	1.8	288	0.05	5.7	0.1	2	0.15	1.8	0.15	1.8	299.3
Madison to Norris	0.59	94.4	0.08	9.12	0.1	2	1.2	14.4	1	12	131.92
Norris to Canyon Village	0.44	70.4	0.05	5.7	0.2	4	0.56	6.72	0.7	8.4	95.22
Canyon Village to Fishing Bridge	0.34	54.4	0.45	51.3	1.4	28	0.36	4.32	0.7	8.4	146.42
Fishing Bridge to East Entrance	0.02	3.2	0.05	5.7	1.6	32	0.02	0.24	0.02	0.24	41.38
Fishing Bridge to West Thumb	0.08	12.8	0.46	52.44	0.3	6	0.02	0.24	0.7	8.4	79.88
Madison to Old Faithful	1.41	225.6	0.47	53.58	0.1	2	1.15	13.8	1.05	12.6	307.58
Old Faithful to West Thumb	0.27	43.2	1.35	153.9	0.2	4	0.05	0.6	0.75	9	210.7
West Thumb to Flagg Ranch	0.05	8	1.75	199.5	0.1	2	0.05	0.6	0.05	0.6	210.7

Snowcoaches	West Entrance 34		South Entrance 13		East Entrance 2		North Entrance 13		Old Faithful 16		Total 78
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.7	0.03	0.39	0.1	0.2	1.8	23.4	0	0	25.69
West Entrance to Madison	1.8	61.2	0.05	0.65	0.1	0.2	0.15	1.95	0.48	7.68	71.68
Madison to Norris	0.59	20.06	0.08	1.04	0.1	0.2	1.2	15.6	0.06	0.96	37.86
Norris to Canyon Village	0.44	14.96	0.05	0.65	0.2	0.4	0.56	7.28	0.06	0.96	24.25
Canyon Village to Fishing Bridge	0.34	11.56	0.45	5.85	1.4	2.8	0.36	4.68	0.06	0.96	25.85
Fishing Bridge to East Entrance	0.02	0.68	0.05	0.65	1.6	3.2	0.02	0.26	0	0	4.79
Fishing Bridge to West Thumb	0.08	2.72	0.46	5.98	0.3	0.6	0.02	0.26	0.06	0.96	10.52
Madison to Old Faithful	1.41	47.94	0.47	6.11	0.1	0.2	1.15	14.95	0.6	9.6	78.8
Old Faithful to West Thumb	0.27	9.18	1.35	17.55	0.2	0.4	0.05	0.65	1.3	20.8	48.58
West Thumb to Flagg Ranch	0.05	1.7	1.75	22.75	0.1	0.2	0.05	0.65	1.18	18.88	44.18

Note:

YELL group sizes are modeled at an average of 8 snowmobiles/group.

2011 DEIS Alternative 3 720 / 78

Snowmobiles	West Entrance 400		South Entrance 220		East Entrance 40		North Entrance 30		Old Faithful 30		Total 720
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	20	0.03	6.6	0.1	4	1.8	54	0.3	9	93.6
West Entrance to Madison	1.8	720	0.05	11	0.1	4	0.15	4.5	0.15	4.5	744
Madison to Norris	0.59	236	0.08	17.6	0.1	4	1.2	36	1	30	323.6
Norris to Canyon Village	0.44	176	0.05	11	0.2	8	0.56	16.8	0.7	21	232.8
Canyon Village to Fishing Bridge	0.34	136	0.45	99	1.4	56	0.36	10.8	0.7	21	322.8
Fishing Bridge to East Entrance	0.02	8	0.05	11	1.6	64	0.02	0.6	0.02	0.6	84.2
Fishing Bridge to West Thumb	0.08	32	0.46	101.2	0.3	12	0.02	0.6	0.7	21	166.8
Madison to Old Faithful	1.41	564	0.47	103.4	0.1	4	1.15	34.5	1.05	31.5	737.4
Old Faithful to West Thumb	0.27	108	1.35	297	0.2	8	0.05	1.5	0.75	22.5	437
West Thumb to Flagg Ranch	0.05	20	1.75	385	0.1	4	0.05	1.5	0.05	1.5	412

Snowcoaches	West Entrance 34		South Entrance 13		East Entrance 2		North Entrance 13		Old Faithful 16		Total 78
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.7	0.03	0.39	0.1	0.2	1.8	23.4	0	0	25.69
West Entrance to Madison	1.8	61.2	0.05	0.65	0.1	0.2	0.15	1.95	0.48	7.68	71.68
Madison to Norris	0.59	20.06	0.08	1.04	0.1	0.2	1.2	15.6	0.06	0.96	37.86
Norris to Canyon Village	0.44	14.96	0.05	0.65	0.2	0.4	0.56	7.28	0.06	0.96	24.25
Canyon Village to Fishing Bridge	0.34	11.56	0.45	5.85	1.4	2.8	0.36	4.68	0.06	0.96	25.85
Fishing Bridge to East Entrance	0.02	0.68	0.05	0.65	1.6	3.2	0.02	0.26	0	0	4.79
Fishing Bridge to West Thumb	0.08	2.72	0.46	5.98	0.3	0.6	0.02	0.26	0.06	0.96	10.52
Madison to Old Faithful	1.41	47.94	0.47	6.11	0.1	0.2	1.15	14.95	0.6	9.6	78.8
Old Faithful to West Thumb	0.27	9.18	1.35	17.55	0.2	0.4	0.05	0.65	1.3	20.8	48.58
West Thumb to Flagg Ranch	0.05	1.7	1.75	22.75	0.1	0.2	0.05	0.65	1.18	18.88	44.18

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

2011 DEIS Alternative 4 - Old Faithful, South, Norris

Snowmobiles	West Entrance		South Entrance		East Entrance		Norris		Old Faithful		Total
	0		66		0		22		22		110
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	0	0	0	0.1	0	0	0	0	0	0
West Entrance to Madison	1.8	0	0	0	0.1	0	0	0	0	0	0
Madison to Norris	0.59	0	0	0	0.1	0	0	0	0	0	0
Norris to Canyon Village	0.44	0	0.1	6.6	0.2	0	1.8	39.6	0.5	11	57.2
Canyon Village to Fishing Bridge	0.34	0	0.4	26.4	1.4	0	0.9	19.8	1.4	30.8	77
Fishing Bridge to East Entrance	0.02	0	0	0	1.6	0	0	0	0	0	0
Fishing Bridge to West Thumb	0.08	0	0.4	26.4	0.3	0	0.8	17.6	1.5	33	77
Madison to Old Faithful	1.41	0	0	0	0.1	0	0	0	0	0	0
Old Faithful to West Thumb	0.27	0	1.4	92.4	0.2	0	0.7	15.4	1.8	39.6	147.4
West Thumb to Flagg Ranch	0.05	0	1.8	118.8	0.1	0	0.1	2.2	0.2	4.4	125.4

Snowcoaches	West Entrance		South Entrance		East Entrance		Norris		Old Faithful		Total
	0		20		0		2		8		30
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	0	0	0	0.1	0	0	0	0	0	0
West Entrance to Madison	1.8	0	0	0	0.1	0	0	0	0	0	0
Madison to Norris	0.59	0	0	0	0.1	0	0	0	0	0	0
Norris to Canyon Village	0.44	0	0.1	2	0.2	0	1.8	3.6	0.5	4	9.6
Canyon Village to Fishing Bridge	0.34	0	0.4	8	1.4	0	0.9	1.8	1.5	12	21.8
Fishing Bridge to East Entrance	0.02	0	0	0	1.6	0	0	0	0	0	0
Fishing Bridge to West Thumb	0.08	0	0.4	8	0.3	0	0.8	1.6	1.6	12.8	22.4
Madison to Old Faithful	1.41	0	0	0	0.1	0	0	0	0	0	0
Old Faithful to West Thumb	0.27	0	1.4	28	0.2	0	0.7	1.4	1.8	14.4	43.8
West Thumb to Flagg Ranch	0.05	0	1.8	36	0.1	0	0.1	0.2	0.2	1.6	37.8

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

Wheeled Vehicles	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	75		0		0		25		0		100
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.3	22.5	0	0	0	0	2	50	0.2	0	72.5
West Entrance to Madison	2	150	0	0	0	0	0.4	10	0.8	0	160
Madison to Norris	0.5	37.5	0	0	0	0	1.9	47.5	0.2	0	85
Norris to Canyon Village	0	0	0	0	0	0	0	0	0	0	0
Canyon Village to Fishing Bridge	0	0	0	0	0	0	0	0	0	0	0
Fishing Bridge to Lake Butte	0	0	0	0	0	0	0	0	0	0	0
Fishing Bridge to West Thumb	0	0	0	0	0	0	0	0	0	0	0
Madison to Old Faithful	1.5	112.5	0	0	0	0	1.5	37.5	1	0	150
Old Faithful to West Thumb	0	0	0	0	0	0	0	0	0	0	0
West Thumb to Flagg Ranch	0	0	0	0	0	0	0	0	0	0	0

2011 DEIS Alternative 5 - Start 318 / 78

Snowmobiles	West Entrance 160		South Entrance 114		East Entrance 20		North Entrance 12		Old Faithful 12		Total 318
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	8	0.03	3.42	0.1	2	1.8	21.6	0.3	3.6	38.62
West Entrance to Madison	1.8	288	0.05	5.7	0.1	2	0.15	1.8	0.15	1.8	299.3
Madison to Norris	0.59	94.4	0.08	9.12	0.1	2	1.2	14.4	1	12	131.92
Norris to Canyon Village	0.44	70.4	0.05	5.7	0.2	4	0.56	6.72	0.7	8.4	95.22
Canyon Village to Fishing Bridge	0.34	54.4	0.45	51.3	1.4	28	0.36	4.32	0.7	8.4	146.42
Fishing Bridge to East Entrance	0.02	3.2	0.05	5.7	1.6	32	0.02	0.24	0.02	0.24	41.38
Fishing Bridge to West Thumb	0.08	12.8	0.46	52.44	0.3	6	0.02	0.24	0.7	8.4	79.88
Madison to Old Faithful	1.41	225.6	0.47	53.58	0.1	2	1.15	13.8	1.05	12.6	307.58
Old Faithful to West Thumb	0.27	43.2	1.35	153.9	0.2	4	0.05	0.6	0.75	9	210.7
West Thumb to Flagg Ranch	0.05	8	1.75	199.5	0.1	2	0.05	0.6	0.05	0.6	210.7

Snowcoaches	West Entrance 34		South Entrance 13		East Entrance 2		North Entrance 13		Old Faithful 16		Total 78
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.7	0.03	0.39	0.1	0.2	1.8	23.4	0	0	25.69
West Entrance to Madison	1.8	61.2	0.05	0.65	0.1	0.2	0.15	1.95	0.48	7.68	71.68
Madison to Norris	0.59	20.06	0.08	1.04	0.1	0.2	1.2	15.6	0.06	0.96	37.86
Norris to Canyon Village	0.44	14.96	0.05	0.65	0.2	0.4	0.56	7.28	0.06	0.96	24.25
Canyon Village to Fishing Bridge	0.34	11.56	0.45	5.85	1.4	2.8	0.36	4.68	0.06	0.96	25.85
Fishing Bridge to East Entrance	0.02	0.68	0.05	0.65	1.6	3.2	0.02	0.26	0	0	4.79
Fishing Bridge to West Thumb	0.08	2.72	0.46	5.98	0.3	0.6	0.02	0.26	0.06	0.96	10.52
Madison to Old Faithful	1.41	47.94	0.47	6.11	0.1	0.2	1.15	14.95	0.6	9.6	78.8
Old Faithful to West Thumb	0.27	9.18	1.35	17.55	0.2	0.4	0.05	0.65	1.3	20.8	48.58
West Thumb to Flagg Ranch	0.05	1.7	1.75	22.75	0.1	0.2	0.05	0.65	1.18	18.88	44.18

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

2011 DEIS Alternative 2 - 318 / 78

Snowmobiles	West Entrance 160		South Entrance 114		East Entrance 20		North Entrance 12		Old Faithful 12		Total 318
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	8	0.03	3.42	0.1	2	1.8	21.6	0.3	3.6	38.62
West Entrance to Madison	1.8	288	0.05	5.7	0.1	2	0.15	1.8	0.15	1.8	299.3
Madison to Norris	0.59	94.4	0.08	9.12	0.1	2	1.2	14.4	1	12	131.92
Norris to Canyon Village	0.44	70.4	0.05	5.7	0.2	4	0.56	6.72	0.7	8.4	95.22
Canyon Village to Fishing Bridge	0.34	54.4	0.45	51.3	1.4	28	0.36	4.32	0.7	8.4	146.42
Fishing Bridge to East Entrance	0.02	3.2	0.05	5.7	1.6	32	0.02	0.24	0.02	0.24	41.38
Fishing Bridge to West Thumb	0.08	12.8	0.46	52.44	0.3	6	0.02	0.24	0.7	8.4	79.88
Madison to Old Faithful	1.41	225.6	0.47	53.58	0.1	2	1.15	13.8	1.05	12.6	307.58
Old Faithful to West Thumb	0.27	43.2	1.35	153.9	0.2	4	0.05	0.6	0.75	9	210.7
West Thumb to Flagg Ranch	0.05	8	1.75	199.5	0.1	2	0.05	0.6	0.05	0.6	210.7

Snowcoaches	West Entrance 34		South Entrance 13		East Entrance 2		North Entrance 13		Old Faithful 16		Total 78
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.7	0.03	0.39	0.1	0.2	1.8	23.4	0	0	25.69
West Entrance to Madison	1.8	61.2	0.05	0.65	0.1	0.2	0.15	1.95	0.48	7.68	71.68
Madison to Norris	0.59	20.06	0.08	1.04	0.1	0.2	1.2	15.6	0.06	0.96	37.86
Norris to Canyon Village	0.44	14.96	0.05	0.65	0.2	0.4	0.56	7.28	0.06	0.96	24.25
Canyon Village to Fishing Bridge	0.34	11.56	0.45	5.85	1.4	2.8	0.36	4.68	0.06	0.96	25.85
Fishing Bridge to East Entrance	0.02	0.68	0.05	0.65	1.6	3.2	0.02	0.26	0	0	4.79
Fishing Bridge to West Thumb	0.08	2.72	0.46	5.98	0.3	0.6	0.02	0.26	0.06	0.96	10.52
Madison to Old Faithful	1.41	47.94	0.47	6.11	0.1	0.2	1.15	14.95	0.6	9.6	78.8
Old Faithful to West Thumb	0.27	9.18	1.35	17.55	0.2	0.4	0.05	0.65	1.3	20.8	48.58
West Thumb to Flagg Ranch	0.05	1.7	1.75	22.75	0.1	0.2	0.05	0.65	1.18	18.88	44.18

Note:

YELL group sizes are modeled at an average of 8 snowmobiles/group.

2011 DEIS Alternative 3 720 / 78

Snowmobiles	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	400		220		40		30		30		720
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	20	0.03	6.6	0.1	4	1.8	54	0.3	9	93.6
West Entrance to Madison	1.8	720	0.05	11	0.1	4	0.15	4.5	0.15	4.5	744
Madison to Norris	0.59	236	0.08	17.6	0.1	4	1.2	36	1	30	323.6
Norris to Canyon Village	0.44	176	0.05	11	0.2	8	0.56	16.8	0.7	21	232.8
Canyon Village to Fishing Bridge	0.34	136	0.45	99	1.4	56	0.36	10.8	0.7	21	322.8
Fishing Bridge to East Entrance	0.02	8	0.05	11	1.6	64	0.02	0.6	0.02	0.6	84.2
Fishing Bridge to West Thumb	0.08	32	0.46	101.2	0.3	12	0.02	0.6	0.7	21	166.8
Madison to Old Faithful	1.41	564	0.47	103.4	0.1	4	1.15	34.5	1.05	31.5	737.4
Old Faithful to West Thumb	0.27	108	1.35	297	0.2	8	0.05	1.5	0.75	22.5	437
West Thumb to Flagg Ranch	0.05	20	1.75	385	0.1	4	0.05	1.5	0.05	1.5	412

Snowcoaches	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	34		13		2		13		16		78
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.7	0.03	0.39	0.1	0.2	1.8	23.4	0	0	25.69
West Entrance to Madison	1.8	61.2	0.05	0.65	0.1	0.2	0.15	1.95	0.48	7.68	71.68
Madison to Norris	0.59	20.06	0.08	1.04	0.1	0.2	1.2	15.6	0.06	0.96	37.86
Norris to Canyon Village	0.44	14.96	0.05	0.65	0.2	0.4	0.56	7.28	0.06	0.96	24.25
Canyon Village to Fishing Bridge	0.34	11.56	0.45	5.85	1.4	2.8	0.36	4.68	0.06	0.96	25.85
Fishing Bridge to East Entrance	0.02	0.68	0.05	0.65	1.6	3.2	0.02	0.26	0	0	4.79
Fishing Bridge to West Thumb	0.08	2.72	0.46	5.98	0.3	0.6	0.02	0.26	0.06	0.96	10.52
Madison to Old Faithful	1.41	47.94	0.47	6.11	0.1	0.2	1.15	14.95	0.6	9.6	78.8
Old Faithful to West Thumb	0.27	9.18	1.35	17.55	0.2	0.4	0.05	0.65	1.3	20.8	48.58
West Thumb to Flagg Ranch	0.05	1.7	1.75	22.75	0.1	0.2	0.05	0.65	1.18	18.88	44.18

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

2011 DEIS Alternative 4 - Old Faithful, South, Norris

Snowmobiles	West Entrance		South Entrance		East Entrance		Norris		Old Faithful		Total
	0		66		0		22		22		110
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	0	0	0	0.1	0	0	0	0	0	0
West Entrance to Madison	1.8	0	0	0	0.1	0	0	0	0	0	0
Madison to Norris	0.59	0	0	0	0.1	0	0	0	0	0	0
Norris to Canyon Village	0.44	0	0.1	6.6	0.2	0	1.8	39.6	0.5	11	57.2
Canyon Village to Fishing Bridge	0.34	0	0.4	26.4	1.4	0	0.9	19.8	1.4	30.8	77
Fishing Bridge to East Entrance	0.02	0	0	0	1.6	0	0	0	0	0	0
Fishing Bridge to West Thumb	0.08	0	0.4	26.4	0.3	0	0.8	17.6	1.5	33	77
Madison to Old Faithful	1.41	0	0	0	0.1	0	0	0	0	0	0
Old Faithful to West Thumb	0.27	0	1.4	92.4	0.2	0	0.7	15.4	1.8	39.6	147.4
West Thumb to Flagg Ranch	0.05	0	1.8	118.8	0.1	0	0.1	2.2	0.2	4.4	125.4

Snowcoaches	West Entrance		South Entrance		East Entrance		Norris		Old Faithful		Total
	0		20		0		2		8		30
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	0	0	0	0.1	0	0	0	0	0	0
West Entrance to Madison	1.8	0	0	0	0.1	0	0	0	0	0	0
Madison to Norris	0.59	0	0	0	0.1	0	0	0	0	0	0
Norris to Canyon Village	0.44	0	0.1	2	0.2	0	1.8	3.6	0.5	4	9.6
Canyon Village to Fishing Bridge	0.34	0	0.4	8	1.4	0	0.9	1.8	1.5	12	21.8
Fishing Bridge to East Entrance	0.02	0	0	0	1.6	0	0	0	0	0	0
Fishing Bridge to West Thumb	0.08	0	0.4	8	0.3	0	0.8	1.6	1.6	12.8	22.4
Madison to Old Faithful	1.41	0	0	0	0.1	0	0	0	0	0	0
Old Faithful to West Thumb	0.27	0	1.4	28	0.2	0	0.7	1.4	1.8	14.4	43.8
West Thumb to Flagg Ranch	0.05	0	1.8	36	0.1	0	0.1	0.2	0.2	1.6	37.8

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

Wheeled Vehicles	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	75		0		0		25		0		100
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.3	22.5	0	0	0	0	2	50	0.2	0	72.5
West Entrance to Madison	2	150	0	0	0	0	0.4	10	0.8	0	160
Madison to Norris	0.5	37.5	0	0	0	0	1.9	47.5	0.2	0	85
Norris to Canyon Village	0	0	0	0	0	0	0	0	0	0	0
Canyon Village to Fishing Bridge	0	0	0	0	0	0	0	0	0	0	0
Fishing Bridge to Lake Butte	0	0	0	0	0	0	0	0	0	0	0
Fishing Bridge to West Thumb	0	0	0	0	0	0	0	0	0	0	0
Madison to Old Faithful	1.5	112.5	0	0	0	0	1.5	37.5	1	0	150
Old Faithful to West Thumb	0	0	0	0	0	0	0	0	0	0	0
West Thumb to Flagg Ranch	0	0	0	0	0	0	0	0	0	0	0

2011 DEIS Alternative 5 - Start 318 / 78

Snowmobiles	West Entrance 160		South Entrance 114		East Entrance 20		North Entrance 12		Old Faithful 12		Total 318
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	8	0.03	3.42	0.1	2	1.8	21.6	0.3	3.6	38.62
West Entrance to Madison	1.8	288	0.05	5.7	0.1	2	0.15	1.8	0.15	1.8	299.3
Madison to Norris	0.59	94.4	0.08	9.12	0.1	2	1.2	14.4	1	12	131.92
Norris to Canyon Village	0.44	70.4	0.05	5.7	0.2	4	0.56	6.72	0.7	8.4	95.22
Canyon Village to Fishing Bridge	0.34	54.4	0.45	51.3	1.4	28	0.36	4.32	0.7	8.4	146.42
Fishing Bridge to East Entrance	0.02	3.2	0.05	5.7	1.6	32	0.02	0.24	0.02	0.24	41.38
Fishing Bridge to West Thumb	0.08	12.8	0.46	52.44	0.3	6	0.02	0.24	0.7	8.4	79.88
Madison to Old Faithful	1.41	225.6	0.47	53.58	0.1	2	1.15	13.8	1.05	12.6	307.58
Old Faithful to West Thumb	0.27	43.2	1.35	153.9	0.2	4	0.05	0.6	0.75	9	210.7
West Thumb to Flagg Ranch	0.05	8	1.75	199.5	0.1	2	0.05	0.6	0.05	0.6	210.7

Snowcoaches	West Entrance 34		South Entrance 13		East Entrance 2		North Entrance 13		Old Faithful 16		Total 78
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.7	0.03	0.39	0.1	0.2	1.8	23.4	0	0	25.69
West Entrance to Madison	1.8	61.2	0.05	0.65	0.1	0.2	0.15	1.95	0.48	7.68	71.68
Madison to Norris	0.59	20.06	0.08	1.04	0.1	0.2	1.2	15.6	0.06	0.96	37.86
Norris to Canyon Village	0.44	14.96	0.05	0.65	0.2	0.4	0.56	7.28	0.06	0.96	24.25
Canyon Village to Fishing Bridge	0.34	11.56	0.45	5.85	1.4	2.8	0.36	4.68	0.06	0.96	25.85
Fishing Bridge to East Entrance	0.02	0.68	0.05	0.65	1.6	3.2	0.02	0.26	0	0	4.79
Fishing Bridge to West Thumb	0.08	2.72	0.46	5.98	0.3	0.6	0.02	0.26	0.06	0.96	10.52
Madison to Old Faithful	1.41	47.94	0.47	6.11	0.1	0.2	1.15	14.95	0.6	9.6	78.8
Old Faithful to West Thumb	0.27	9.18	1.35	17.55	0.2	0.4	0.05	0.65	1.3	20.8	48.58
West Thumb to Flagg Ranch	0.05	1.7	1.75	22.75	0.1	0.2	0.05	0.65	1.18	18.88	44.18

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

2011 DEIS Alternative 5 - Final 0 / 120

Snowmobiles	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	0		0		0		0		0		0
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	0	0.03	0	0.1	0	1.8	0	0.3	0	0
West Entrance to Madison	1.8	0	0.05	0	0.1	0	0.15	0	0.15	0	0
Madison to Norris	0.59	0	0.08	0	0.1	0	1.2	0	1	0	0
Norris to Canyon Village	0.44	0	0.05	0	0.2	0	0.56	0	0.7	0	0
Canyon Village to Fishing Bridge	0.34	0	0.45	0	1.4	0	0.36	0	0.7	0	0
Fishing Bridge to East Entrance	0.02	0	0.05	0	1.6	0	0.02	0	0.02	0	0
Fishing Bridge to West Thumb	0.08	0	0.46	0	0.3	0	0.02	0	0.7	0	0
Madison to Old Faithful	1.41	0	0.47	0	0.1	0	1.15	0	1.05	0	0
Old Faithful to West Thumb	0.27	0	1.35	0	0.2	0	0.05	0	0.75	0	0
West Thumb to Flagg Ranch	0.05	0	1.75	0	0.1	0	0.05	0	0.05	0	0

Snowcoaches	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	56		24		6		14		20		120
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	2.8	0.03	0.72	0.1	0.6	1.8	25.2	0	0	29.32
West Entrance to Madison	1.8	100.8	0.05	1.2	0.1	0.6	0.15	2.1	0.48	9.6	114.3
Madison to Norris	0.59	33.04	0.08	1.92	0.1	0.6	1.2	16.8	0.06	1.2	53.56
Norris to Canyon Village	0.44	24.64	0.05	1.2	0.2	1.2	0.56	7.84	0.06	1.2	36.08
Canyon Village to Fishing Bridge	0.34	19.04	0.45	10.8	1.4	8.4	0.36	5.04	0.06	1.2	44.48
Fishing Bridge to East Entrance	0.02	1.12	0.05	1.2	1.6	9.6	0.02	0.28	0	0	12.2
Fishing Bridge to West Thumb	0.08	4.48	0.46	11.04	0.3	1.8	0.02	0.28	0.06	1.2	18.8
Madison to Old Faithful	1.41	78.96	0.47	11.28	0.1	0.6	1.15	16.1	0.6	12	118.94
Old Faithful to West Thumb	0.27	15.12	1.35	32.4	0.2	1.2	0.05	0.7	1.3	26	75.42
West Thumb to Flagg Ranch	0.05	2.8	1.75	42	0.1	0.6	0.05	0.7	1.18	23.6	69.7

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

2011 DEIS Alternative 5 - Final 0 / 120

Snowmobiles	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	0		0		0		0		0		0
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	0	0.03	0	0.1	0	1.8	0	0.3	0	0
West Entrance to Madison	1.8	0	0.05	0	0.1	0	0.15	0	0.15	0	0
Madison to Norris	0.59	0	0.08	0	0.1	0	1.2	0	1	0	0
Norris to Canyon Village	0.44	0	0.05	0	0.2	0	0.56	0	0.7	0	0
Canyon Village to Fishing Bridge	0.34	0	0.45	0	1.4	0	0.36	0	0.7	0	0
Fishing Bridge to East Entrance	0.02	0	0.05	0	1.6	0	0.02	0	0.02	0	0
Fishing Bridge to West Thumb	0.08	0	0.46	0	0.3	0	0.02	0	0.7	0	0
Madison to Old Faithful	1.41	0	0.47	0	0.1	0	1.15	0	1.05	0	0
Old Faithful to West Thumb	0.27	0	1.35	0	0.2	0	0.05	0	0.75	0	0
West Thumb to Flagg Ranch	0.05	0	1.75	0	0.1	0	0.05	0	0.05	0	0

Snowcoaches	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	56		24		6		14		20		120
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	2.8	0.03	0.72	0.1	0.6	1.8	25.2	0	0	29.32
West Entrance to Madison	1.8	100.8	0.05	1.2	0.1	0.6	0.15	2.1	0.48	9.6	114.3
Madison to Norris	0.59	33.04	0.08	1.92	0.1	0.6	1.2	16.8	0.06	1.2	53.56
Norris to Canyon Village	0.44	24.64	0.05	1.2	0.2	1.2	0.56	7.84	0.06	1.2	36.08
Canyon Village to Fishing Bridge	0.34	19.04	0.45	10.8	1.4	8.4	0.36	5.04	0.06	1.2	44.48
Fishing Bridge to East Entrance	0.02	1.12	0.05	1.2	1.6	9.6	0.02	0.28	0	0	12.2
Fishing Bridge to West Thumb	0.08	4.48	0.46	11.04	0.3	1.8	0.02	0.28	0.06	1.2	18.8
Madison to Old Faithful	1.41	78.96	0.47	11.28	0.1	0.6	1.15	16.1	0.6	12	118.94
Old Faithful to West Thumb	0.27	15.12	1.35	32.4	0.2	1.2	0.05	0.7	1.3	26	75.42
West Thumb to Flagg Ranch	0.05	2.8	1.75	42	0.1	0.6	0.05	0.7	1.18	23.6	69.7

Note:

YELL group sizes are modeled at 8 snowmobiles/group.

2011 DEIS Alternative 6 - Average Use Day (if seasonal limits are reached)

Snowmobiles	**West Entrance**		**South Entrance**		**East Entrance**		**North Entrance**		**Old Faithful**		**Total**
	198		**99**		**26.4**		**19.8**		**13.2**		**356.4**
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	9.9	0.03	2.97	0.1	2.64	1.8	35.64	0.3	3.96	55.11
West Entrance to Madison	1.8	356.4	0.05	4.95	0.1	2.64	0.15	2.97	0.15	1.98	368.94
Madison to Norris	0.59	116.82	0.08	7.92	0.1	2.64	1.2	23.76	1	13.2	164.34
Norris to Canyon Village	0.44	87.12	0.05	4.95	0.2	5.28	0.56	11.088	0.7	9.24	117.678
Canyon Village to Fishing Bridge	0.34	67.32	0.45	44.55	1.4	36.96	0.36	7.128	0.7	9.24	165.198
Fishing Bridge to East Entrance	0.02	3.96	0.05	4.95	1.6	42.24	0.02	0.396	0.02	0.264	51.81
Fishing Bridge to West Thumb	0.08	15.84	0.46	45.54	0.3	7.92	0.02	0.396	0.7	9.24	78.936
Madison to Old Faithful	1.41	279.18	0.47	46.53	0.1	2.64	1.15	22.77	1.05	13.86	364.98
Old Faithful to West Thumb	0.27	53.46	1.35	133.65	0.2	5.28	0.05	0.99	0.75	9.9	203.28
West Thumb to Flagg Ranch	0.05	9.9	1.75	173.25	0.1	2.64	0.05	0.99	0.05	0.66	187.44

Snowcoaches	**West Entrance**		**South Entrance**		**East Entrance**		**North Entrance**		**Old Faithful**		**Total**
	22.44		**8.58**		**1.32**		**8.58**		**10.56**		**51.48**
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.122	0.03	0.2574	0.1	0.132	1.8	15.444	0	0	16.9554
West Entrance to Madison	1.8	40.392	0.05	0.429	0.1	0.132	0.15	1.287	0.48	5.0688	47.3088
Madison to Norris	0.59	13.2396	0.08	0.6864	0.1	0.132	1.2	10.296	0.06	0.6336	24.9876
Norris to Canyon Village	0.44	9.8736	0.05	0.429	0.2	0.264	0.56	4.8048	0.06	0.6336	16.005
Canyon Village to Fishing Bridge	0.34	7.6296	0.45	3.861	1.4	1.848	0.36	3.0888	0.06	0.6336	17.061
Fishing Bridge to East Entrance	0.02	0.4488	0.05	0.429	1.6	2.112	0.02	0.1716	0	0	3.1614
Fishing Bridge to West Thumb	0.08	1.7952	0.46	3.9468	0.3	0.396	0.02	0.1716	0.06	0.6336	6.9432
Madison to Old Faithful	1.41	31.6404	0.47	4.0326	0.1	0.132	1.15	9.867	0.6	6.336	52.008
Old Faithful to West Thumb	0.27	6.0588	1.35	11.583	0.2	0.264	0.05	0.429	1.3	13.728	32.0628
West Thumb to Flagg Ranch	0.05	1.122	1.75	15.015	0.1	0.132	0.05	0.429	1.18	12.4608	29.1588

Note:

Alternative 6 (average) has a seasonal limit of 32,000 snowmobiles and 4,600 for snowcoaches (2/3 of 540*90 and 2/3 of 78*90).
The daily numbers for each entrance were calculated by multiplying Alternative 6 maximum daily entrance numbers by 2/3 (.66).
YELL group sizes are modeled at 22 snowmobiles/group.

2011 DEIS Alternative 6 - Maximum Use Day

Snowmobiles	West Entrance 300		South Entrance 150		East Entrance 40		North Entrance 30		Old Faithful 20		Total 540
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	15	0.03	4.5	0.1	4	1.8	54	0.3	6	83.5
West Entrance to Madison	1.8	540	0.05	7.5	0.1	4	0.15	4.5	0.15	3	559
Madison to Norris	0.59	177	0.08	12	0.1	4	1.2	36	1	20	249
Norris to Canyon Village	0.44	132	0.05	7.5	0.2	8	0.56	16.8	0.7	14	178.3
Canyon Village to Fishing Bridge	0.34	102	0.45	67.5	1.4	56	0.36	10.8	0.7	14	250.3
Fishing Bridge to East Entrance	0.02	6	0.05	7.5	1.6	64	0.02	0.6	0.02	0.4	78.5
Fishing Bridge to West Thumb	0.08	24	0.46	69	0.3	12	0.02	0.6	0.7	14	119.6
Madison to Old Faithful	1.41	423	0.47	70.5	0.1	4	1.15	34.5	1.05	21	553
Old Faithful to West Thumb	0.27	81	1.35	202.5	0.2	8	0.05	1.5	0.75	15	308
West Thumb to Flagg Ranch	0.05	15	1.75	262.5	0.1	4	0.05	1.5	0.05	1	284

Snowcoaches	West Entrance 34		South Entrance 13		East Entrance 2		North Entrance 13		Old Faithful 16		Total 78
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.7	0.03	0.39	0.1	0.2	1.8	23.4	0	0	25.69
West Entrance to Madison	1.8	61.2	0.05	0.65	0.1	0.2	0.15	1.95	0.48	7.68	71.68
Madison to Norris	0.59	20.06	0.08	1.04	0.1	0.2	1.2	15.6	0.06	0.96	37.86
Norris to Canyon Village	0.44	14.96	0.05	0.65	0.2	0.4	0.56	7.28	0.06	0.96	24.25
Canyon Village to Fishing Bridge	0.34	11.56	0.45	5.85	1.4	2.8	0.36	4.68	0.06	0.96	25.85
Fishing Bridge to East Entrance	0.02	0.68	0.05	0.65	1.6	3.2	0.02	0.26	0	0	4.79
Fishing Bridge to West Thumb	0.08	2.72	0.46	5.98	0.3	0.6	0.02	0.26	0.06	0.96	10.52
Madison to Old Faithful	1.41	47.94	0.47	6.11	0.1	0.2	1.15	14.95	0.6	9.6	78.8
Old Faithful to West Thumb	0.27	9.18	1.35	17.55	0.2	0.4	0.05	0.65	1.3	20.8	48.58
West Thumb to Flagg Ranch	0.05	1.7	1.75	22.75	0.1	0.2	0.05	0.65	1.18	18.88	44.18

Note:

YELL group sizes are modeled at 22 snowmobiles/group.

2011 DEIS Alternative 7 - 132 / 30 days

Snowmobiles	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	66		44		0		11		11		132
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	3.3	0.03	1.32	0.1	0	1.8	19.8	0.3	3.3	27.72
West Entrance to Madison	1.8	118.8	0.05	2.2	0.1	0	0.15	1.65	0.15	1.65	124.3
Madison to Norris	0.59	38.94	0.08	3.52	0.1	0	1.2	13.2	1	11	66.66
Norris to Canyon Village	0.44	29.04	0.05	2.2	0.2	0	0.56	6.16	0.7	7.7	45.1
Canyon Village to Fishing Bridge	0.34	22.44	0.45	19.8	1.4	0	0.36	3.96	0.7	7.7	53.9
Fishing Bridge to East Entrance	0.02	1.32	0.05	2.2	1.6	0	0.02	0.22	0.02	0.22	3.96
Fishing Bridge to West Thumb	0.08	5.28	0.46	20.24	0.3	0	0.02	0.22	0.7	7.7	33.44
Madison to Old Faithful	1.41	93.06	0.47	20.68	0.1	0	1.15	12.65	1.05	11.55	137.94
Old Faithful to West Thumb	0.27	17.82	1.35	59.4	0.2	0	0.05	0.55	0.75	8.25	86.02
West Thumb to Flagg Ranch	0.05	3.3	1.75	77	0.1	0	0.05	0.55	0.05	0.55	81.4

Snowcoaches	West Entrance		South Entrance		East Entrance		North Entrance		Old Faithful		Total
	12		6		0		6		6		30
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	0.6	0.03	0.18	0.1	0	1.8	10.8	0	0	11.58
West Entrance to Madison	1.8	21.6	0.05	0.3	0.1	0	0.15	0.9	0.48	2.88	25.68
Madison to Norris	0.59	7.08	0.08	0.48	0.1	0	1.2	7.2	0.06	0.36	15.12
Norris to Canyon Village	0.44	5.28	0.05	0.3	0.2	0	0.56	3.36	0.06	0.36	9.3
Canyon Village to Fishing Bridge	0.34	4.08	0.45	2.7	1.4	0	0.36	2.16	0.06	0.36	9.3
Fishing Bridge to East Entrance	0.02	0.24	0.05	0.3	1.6	0	0.02	0.12	0	0	0.66
Fishing Bridge to West Thumb	0.08	0.96	0.46	2.76	0.3	0	0.02	0.12	0.06	0.36	4.2
Madison to Old Faithful	1.41	16.92	0.47	2.82	0.1	0	1.15	6.9	0.6	3.6	30.24
Old Faithful to West Thumb	0.27	3.24	1.35	8.1	0.2	0	0.05	0.3	1.3	7.8	19.44
West Thumb to Flagg Ranch	0.05	0.6	1.75	10.5	0.1	0	0.05	0.3	1.18	7.08	18.48

Note:

YELL group sizes are modeled at an average of 8 snowmobiles/group.

2011 DEIS Alternative 7 - 220 / 50 days

Snowmobiles	West Entrance 110		South Entrance 66		East Entrance 22		North Entrance 11		Old Faithful 11		Total 220
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	5.5	0.03	1.98	0.1	2.2	1.8	19.8	0.3	3.3	32.78
West Entrance to Madison	1.8	198	0.05	3.3	0.1	2.2	0.15	1.65	0.15	1.65	206.8
Madison to Norris	0.59	64.9	0.08	5.28	0.1	2.2	1.2	13.2	1	11	96.58
Norris to Canyon Village	0.44	48.4	0.05	3.3	0.2	4.4	0.56	6.16	0.7	7.7	69.96
Canyon Village to Fishing Bridge	0.34	37.4	0.45	29.7	1.4	30.8	0.36	3.96	0.7	7.7	109.56
Fishing Bridge to East Entrance	0.02	2.2	0.05	3.3	1.6	35.2	0.02	0.22	0.02	0.22	41.14
Fishing Bridge to West Thumb	0.08	8.8	0.46	30.36	0.3	6.6	0.02	0.22	0.7	7.7	53.68
Madison to Old Faithful	1.41	155.1	0.47	31.02	0.1	2.2	1.15	12.65	1.05	11.55	212.52
Old Faithful to West Thumb	0.27	29.7	1.35	89.1	0.2	4.4	0.05	0.55	0.75	8.25	132
West Thumb to Flagg Ranch	0.05	5.5	1.75	115.5	0.1	2.2	0.05	0.55	0.05	0.55	124.3

Snowcoaches	West Entrance 22		South Entrance 8		East Entrance 2		North Entrance 8		Old Faithful 10		Total 50
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.1	0.03	0.24	0.1	0.2	1.8	14.4	0	0	15.94
West Entrance to Madison	1.8	39.6	0.05	0.4	0.1	0.2	0.15	1.2	0.48	4.8	46.2
Madison to Norris	0.59	12.98	0.08	0.64	0.1	0.2	1.2	9.6	0.06	0.6	24.02
Norris to Canyon Village	0.44	9.68	0.05	0.4	0.2	0.4	0.56	4.48	0.06	0.6	15.56
Canyon Village to Fishing Bridge	0.34	7.48	0.45	3.6	1.4	2.8	0.36	2.88	0.06	0.6	17.36
Fishing Bridge to East Entrance	0.02	0.44	0.05	0.4	1.6	3.2	0.02	0.16	0	0	4.2
Fishing Bridge to West Thumb	0.08	1.76	0.46	3.68	0.3	0.6	0.02	0.16	0.06	0.6	6.8
Madison to Old Faithful	1.41	31.02	0.47	3.76	0.1	0.2	1.15	9.2	0.6	6	50.18
Old Faithful to West Thumb	0.27	5.94	1.35	10.8	0.2	0.4	0.05	0.4	1.3	13	30.54
West Thumb to Flagg Ranch	0.05	1.1	1.75	14	0.1	0.2	0.05	0.4	1.18	11.8	27.5

Note:

YELL group sizes are modeled at an average of 8 snowmobiles/group.

2011 DEIS Alternative 7 - 330 / 80 days

Snowmobiles	West Entrance 176		South Entrance 110		East Entrance 22		North Entrance 11		Old Faithful 11		Total 330
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	8.8	0.03	3.3	0.1	2.2	1.8	19.8	0.3	3.3	37.4
West Entrance to Madison	1.8	316.8	0.05	5.5	0.1	2.2	0.15	1.65	0.15	1.65	327.8
Madison to Norris	0.59	103.84	0.08	8.8	0.1	2.2	1.2	13.2	1	11	139.04
Norris to Canyon Village	0.44	77.44	0.05	5.5	0.2	4.4	0.56	6.16	0.7	7.7	101.2
Canyon Village to Fishing Bridge	0.34	59.84	0.45	49.5	1.4	30.8	0.36	3.96	0.7	7.7	151.8
Fishing Bridge to East Entrance	0.02	3.52	0.05	5.5	1.6	35.2	0.02	0.22	0.02	0.22	44.66
Fishing Bridge to West Thumb	0.08	14.08	0.46	50.6	0.3	6.6	0.02	0.22	0.7	7.7	79.2
Madison to Old Faithful	1.41	248.16	0.47	51.7	0.1	2.2	1.15	12.65	1.05	11.55	326.26
Old Faithful to West Thumb	0.27	47.52	1.35	148.5	0.2	4.4	0.05	0.55	0.75	8.25	209.22
West Thumb to Flagg Ranch	0.05	8.8	1.75	192.5	0.1	2.2	0.05	0.55	0.05	0.55	204.6

Snowcoaches	West Entrance 36		South Entrance 14		East Entrance 2		North Entrance 12		Old Faithful 16		Total 80
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.05	1.8	0.03	0.42	0.1	0.2	1.8	21.6	0	0	24.02
West Entrance to Madison	1.8	64.8	0.05	0.7	0.1	0.2	0.15	1.8	0.48	7.68	75.18
Madison to Norris	0.59	21.24	0.08	1.12	0.1	0.2	1.2	14.4	0.06	0.96	37.92
Norris to Canyon Village	0.44	15.84	0.05	0.7	0.2	0.4	0.56	6.72	0.06	0.96	24.62
Canyon Village to Fishing Bridge	0.34	12.24	0.45	6.3	1.4	2.8	0.36	4.32	0.06	0.96	26.62
Fishing Bridge to East Entrance	0.02	0.72	0.05	0.7	1.6	3.2	0.02	0.24	0	0	4.86
Fishing Bridge to West Thumb	0.08	2.88	0.46	6.44	0.3	0.6	0.02	0.24	0.06	0.96	11.12
Madison to Old Faithful	1.41	50.76	0.47	6.58	0.1	0.2	1.15	13.8	0.6	9.6	80.94
Old Faithful to West Thumb	0.27	9.72	1.35	18.9	0.2	0.4	0.05	0.6	1.3	20.8	50.42
West Thumb to Flagg Ranch	0.05	1.8	1.75	24.5	0.1	0.2	0.05	0.6	1.18	18.88	45.98

Note:

YELL group sizes are modeled at an average of 8 snowmobiles/group.

2011 DEIS Administrative Travel - Estimated Average Use Each Day

Snowmobiles	**West Entrance**		**South Entrance**		**East Entrance**		**North Entrance**		**Old Faithful**		**Total**
	20		**20**		**20**		**20**		**30**		**110**
	(Madison-5)		(Grant-5)		(Canyon5 Lake10)						
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.1	2	0.1	2	0.1	2	2	40	0.2	6	52
West Entrance to Madison	1.5	30	0.1	2	0.1	2	0.4	8	0.3	9	51
Madison to Norris	0.2	4	0.1	2	0.1	2	1.4	28	0.2	6	42
Norris to Canyon Village	0.1	2	0.1	2	0.2	4	0.6	12	0.1	3	23
Canyon Village to Fishing Bridge	0.1	2	0.1	2	1.4	28	0.2	4	0.1	3	39
Fishing Bridge to East Entrance	0.1	2	0.1	2	0.3	6	0.1	2	0.1	3	15
Fishing Bridge to West Thumb	0.1	2	0.5	10	1.6	32	0.1	2	0.1	3	49
Madison to Old Faithful	0.3	6	0.1	2	0.1	2	1	20	1	30	60
Old Faithful to West Thumb	0.1	2	0.5	10	0.2	4	0.1	2	1	30	48
West Thumb to Flagg Ranch	0.1	2	1	20	0.1	2	0.1	2	0.1	3	29

Snowcoaches	**West Entrance**		**South Entrance**		**East Entrance**		**North Entrance**		**Old Faithful**		**Total**
	2		**2**		**3**		**2**		**4**		**13**
	(Madison-1)		(Grant-1)		(Canyon-1 Lake-1)						
YELL Road Segment	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	**Factor**	**Results**	
Mammoth to Norris	0.1	0.2	0.1	0.2	0.1	0.3	2	4	0.2	0.8	5.5
West Entrance to Madison	1.5	3	0.1	0.2	0.1	0.3	0.4	0.8	0.3	1.2	5.5
Madison to Norris	0.2	0.4	0.1	0.2	0.1	0.3	1.4	2.8	0.2	0.8	4.5
Norris to Canyon Village	0.1	0.2	0.1	0.2	0.2	0.6	0.6	1.2	0.1	0.4	2.6
Canyon Village to Fishing Bridge	0.1	0.2	0.1	0.2	1.4	4.2	0.2	0.4	0.1	0.4	5.4
Fishing Bridge to East Entrance	0.1	0.2	0.1	0.2	0.3	0.9	0.1	0.2	0.1	0.4	1.9
Fishing Bridge to West Thumb	0.1	0.2	0.5	1	1.6	4.8	0.1	0.2	0.1	0.4	6.6
Madison to Old Faithful	0.3	0.6	0.1	0.2	0.1	0.3	1	2	1	4	7.1
Old Faithful to West Thumb	0.1	0.2	0.5	1	0.2	0.6	0.1	0.2	1	4	6
West Thumb to Flagg Ranch	0.1	0.2	1	2	0.1	0.3	0.1	0.2	0.1	0.4	3.1

Administrative Local Routes				
See note below regarding Old Faithful				

Note:

In the Old Faithful developed area, all 30 snowmobiles and 4 snowcoaches originating would operate in the developed area.
In addition, 24 snowmobiles and 3 snowcoaches originating elsewhere would operate in the Old Faithful developed area (half of those orginating elsewhere).

APPENDIX C: YELLOWSTONE WINTER USE NOISE MODELING FOR THE 2011 EIS

APPENDIX C: YELLOWSTONE WINTER USE NOISE MODELING FOR THE 2011 EIS

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One of the most spatially extensive environmental effects of any transportation system is noise. Noise models are routinely used in airport and road projects to compare the effects of different alternatives. Accordingly, acoustical modeling has played an important role in previous winter use planning for Yellowstone and Grand Teton National Parks. Perhaps the most significant challenge for noise modeling at Yellowstone is the requirement that the audibility of over snow vehicle (OSV) noise be predicted, in terms of spatial extent and duration of effects. The challenge arises from two causes: the extremely low background sound levels that occur during winter in the park, and uncertainties regarding the attenuation of noise energy at very long ranges. This report describes the methods that were used to model OSV noise to support the next winter use plan.

There are two noise propagation models available to the NPS that can model audibility: the Integrated Noise Model (INM) developed by the John A. Volpe National Transportation Systems Center (Volpe: Cambridge, MA), and the Noise Simulation Model (NMSim) developed by Wyle Laboratories (Arlington, VA). NMSim was derived from the Noisemap model used by the U. S. Air Force. Both models were developed to address aircraft noise, but they are readily adaptable to ground noise sources. INM and NMSim take slightly different approaches to noise modeling. INM integrates noise exposure from route segments for each vehicle using the time required to transit that segment and the vehicle noise output. NMSim simulates the noise radiated by each vehicle at closely spaced points along each route. NMSim can explicitly simulate the scheduling of multiple vehicle movements, and can produce noise map animations to illustrate its results.

In 1998 an interagency, multidisciplinary noise model validation study was initiated to empirically test the ability of four noise models to predict the audibility of aircraft noise at Grand Canyon. Forty-seven scientists and engineers from ten federal agencies and engineering companies participated in the study design, execution, and review of the results. The final report (Miller et al. 2003) concluded: “Overall, NMSim proved to be the best model for computing aircraft audibility, because it is shown to have the most consistent combination of low error, low bias, and low scatter for virtually all comparisons.” A subsequent review by the Federal Interagency Committee on Aircraft Noise (Fleming et al. 2005) included the following statements comparing INM and NMSim:

> The components of both INM Version 6.2 and NMSim are based on well-established physics, and have been field validated.
>
> Substantial gains have been made with regard to understanding model-to-model differences; and many of those differences have been reduced or eliminated. However, when comparing INM Version 6.2 and NMSim, there still remain some differences, particularly with point-to-point comparisons.
>
> Both INM Version 6.2 and NMSim are performing equally well, on average, when compared with the “gold standard” audibility data measured in the GCNP MVS.

GCNP MVS refers to Miller et al. 2003.

INM was used in the OSV noise study conducted by Volpe in support of the 2007 Yellowstone EIS (Hastings et al. 2006). The report found that the percent of the park area in which any OSV noise would be audible varied from 10-15% for the modeled alternatives. However, the 2007 EIS noted that INM underestimated the measured sound level of OSVs at eight of twelve monitoring sites in the park and underestimated the percent time audible at seven of twelve sites (and overestimated audibility at one site).

INM and NMSim take slightly different approaches to noise modeling, but they should generate comparable results (Fleming et al. 2005). Continued use of INM offers the strongest basis of comparison between any forthcoming alternatives modeling and the previous results, because differences in model outputs will be entirely due to differences in model inputs. Use of NMSim offers an opportunity to broadly cross-validate the results of the different noise models, and to identify modeling results that are contingent on the model used. Stated differently, INM offers more precise comparisons between future noise model results and the 2006 studies, while NMSim modeling would explore how strongly the noise mapping results depend upon the model used.

Given the systematic underestimation of noise exposure in the previous INM model results, we were inclined to use NMSim to see if a different model would produce better agreement with the monitoring data. Two additional considerations further tipped the balance of this choice towards NMSim. NMSim’s capability to produce animated maps showing the temporal and spatial dynamics of noise exposure will be valuable for public outreach and interpretation. In addition, NSNS is working with one of the developers of NMSim to integrate sound propagation code that can account for some effects of wind and temperature inversions into NMSim. Previous winter use NEPA documents have acknowledged the substantial effects of these atmospheric conditions on noise propagation in the park. For example, temperature inversions will cause OSV noise to be audible at greater distances than would be predicted under neutral atmospheric conditions (when sound travels along straight ray paths). NMSim will provide the capacity to evaluate these effects quantitatively in the near future.

NMSIM PARAMETERS

We used NMSim (Noise Model Simulation; Wyle Laboratories) to simulate over snow vehicles and potential wheeled vehicle traffic in Yellowstone National Park (YELL). These models were based on data from several sources. A topographic raster file of the study area was ingested from the USGS Seamless Data Warehouse (www.seamless.usgs.gov). To realize compatibility with NMSim, this file was converted into an ASCII file using ArcCatalog version 9.3. The acoustic ground impedance was set to 40 Rayls, corresponding to snow-covered terrain. The air temperature and relative humidity were set to -8.4°C and 73.9% respectively, the seasonal averages for Yellowstone (Hastings et al. 2006). NMSim, like INM, can calculate several summary metrics of noise exposure at sites of interest. Thirteen sites were specified (ibid., Figure 28), with a receiver height of four feet above ground level (AGL). All of these choices conformed to the values used for the previous INM modeling (ibid.). One difference between the NMSim modeling and the previous INM models was the ambient sound level specification. The INM models designated two zones of ambient; these NMSim runs simplified the analysis by applying the 1/3 octave spectra data from the “Forested Area Acoustic Zone” (ibid. Table 1) throughout the park.

The NMSim simulations utilized a grid size of 200×200 points to evaluate noise exposure throughout Yellowstone. This corresponded to a spatial resolution of approximately 500 m. The full grid and receiver location data for every run were both saved to text files. The full grid data provided the raw material for subsequent evaluations of the aggregate noise exposure due to the full complement of OSV traffic on each route for each of the proposed management alternatives. The receiver location data provided convenient summaries of noise exposure at specific locations. The full grid output is a text file containing all of the 1/3 octave band data at each time step for every grid point. The receiver output is a text file that contains all of the 1/3 octave band data at each time step for every point of interest and some additional summary metrics.

Each NMS simulation required a trajectory file for the modeled vehicle. This trajectory file incorporated vehicle type, speed, direction of travel, and noise source height as parameters. The snow roads in the park were split into modeled road segments and saved as shape files using ArcGIS 9.3. Each segment shape file was imported into NMSim as a base layer. This base layer was used as a frame of reference to digitize each trajectory. OSV noise source heights were 0.47 m above ground level (AGL) for snowmobiles and 0.91 m AGL for snowcoaches. Wheeled vehicles source heights were 0.47 m AGL for the car and 0.61 m AGL for the bus and medium truck sources.

The road segments that make up the West Entrance to Old Faithful route were modeled at 40 kph (25 mph) and 56 kph (35 mph) for the snowmobile and 40 kph (25 mph) for the snowcoaches. Every other route in the park was modeled using 56 kph (35 mph) and 72 kph (45 mph) for the snowmobile and 40 kph (25 mph) for the snowcoaches. All wheeled vehicles were modeled at 56 kph (35 mph). These speeds were based on local speed limits and park expert observations regarding typical operating speeds. A 5-second time step was used for these simulations, resulting in an approximate spatial resolution of 100 m.

The noise source spectra for the simulations were obtained from the U. S. DOT Volpe Transportation Center. These source data were obtained at a standard measurement distance of 15 m (50 ft). They were transformed for use in NMSim by changing the levels to correspond to a reference distance of 305 m (1000 ft). This transformation utilized instructions provided by the developers of NMSim.

INTERACTIVE MAPPING FRAMEWORK

Noise modeling is a computationally intensive process. Modeling a full alternative can require more than one week of continuous processing on several computers. This delay inhibits an iterative, interactive process of alternative development and evaluation. In order to remove this obstacle, NSNS developed a software framework to separate the computationally intensive effort from the assessment of composite noise impacts. The isolated noise impacts of each component of all planned alternatives were computed in advance. Subsequently, an interactive program was used to add the individual noise contributions together to calculate the composite noise exposure from all operations.

The first step was to identify all of the unique combinations of vehicle type, operating parameters, and route segment that might be evaluated in the alternatives development process. For Yellowstone, this involved identifying the segments of the snow road network that could have different traffic levels. The following table lists the junctions that defined the endpoints of the road segments that were modeled:

Location	Vehicles modeled
Upper Terrace, Mammoth Hot Springs	Snowcoaches, Snowmobiles, wheeled vehicles
Norris Junction	Snowcoaches, Snowmobiles, wheeled vehicles
Canyon Village	Snowcoaches, Snowmobiles
West Entrance	Snowcoaches, Snowmobiles, wheeled vehicles
Madison Junction	Snowcoaches, Snowmobiles, wheeled vehicles
Fishing Bridge	Snowcoaches, Snowmobiles
East Entrance	Snowcoaches, Snowmobiles
Old Faithful	Snowcoaches, Snowmobiles, wheeled vehicles
West Thumb	Snowcoaches, Snowmobiles
South Entrance	Snowcoaches, Snowmobiles

Note that typical routes involved a combination of two or more segments. A trip from Mammoth Hot Springs to Old Faithful would involve a combination of the Mammoth-Norris, Norris-Madison, and Madison-Old Faithful segments. For the winter use analysis, ten road segments were modeled.

Each segment was modeled in both directions of travel. NMSim accounts for the change in engine loading with the slope of the road, as well as the speed of the vehicle. Seven vehicle types were modeled to support evaluation of the Yellowstone winter use alternatives: three types of snowcoaches, three types of wheeled vehicles, and a 4-stroke snowmobile. The wheeled vehicles were modeled for two routes: West Entrance to Old Faithful and Mammoth/Upper Terrace to Old Faithful (totaling four road segments). Over snow vehicles were modeled for all ten road segments.

More than 200 NMSim simulations were computed; 84 of these were used to evaluate the EIS alternatives (the EIS analysis was simplified by selecting a single snowcoach type). The simulations took more than a week, with several machines running continuously. They generated nearly one terabyte of output data. These data were processed by software developed by NSNS to compress and index the data for faster loading by a subsequent program. This compression required about one day of continuous processing time.

The interactive software developed by NSNS ingests two files: a comma separated value (CSV) file containing the traffic levels for each vehicle, operating condition, and route segment, and the large data file with the NMSim noise data for each operation. This program generates several maps that graphically summarize the spatial extent of noise exposure, as well as tables providing numerical summaries of noise.

The NSNS iterative mapping framework has several benefits. New kinds of noise maps and tabular summaries can be rapidly implemented, thanks to the flexible structure of this software. All of the NSNS code was implemented in R, an open source software environment that is available for free (R Development Core Team 2010). More importantly, the consequences of revised alternatives can be evaluated in a few minutes, or about 1000 times quicker than would be possible if the revised alternative had to be modeled by computing a full set of noise models.

The computations in this iterative framework utilize the exact same computations that the models would employ if they were used to process the composite alternatives. For peak noise exposure levels, the iterative framework simply identifies the component of the local traffic that generated the loudest event. Aggregate noise energy is very simple to compute, as noise energy from multiple sources can be summed. This simple approach to summing noise energy assumes that the noise signals of different sources are uncorrelated, an assumption that will rarely be violated. For temporal metrics, like the duration of audibility, this framework uses a statistical formula that accounts for the probable overlap of adjacent noise events. This formula is adapted from Tanner (1951). Tests of this formula by the U. S. DOT Volpe Transportation Center using data from the interagency model validation study at Grand Canyon (Miller et al. 2003) have proven this formula to provide the most accurate fit to the field data of the methods tested thus far.

NOISE METRICS

The choice of noise metrics was motivated by three considerations: sustaining connections to previous noise impact analyses for Yellowstone and other NPS park units, incorporating knowledge gained from recent research and engineering developments, and improving the robustness of the results by diminishing the potential effects of modeling idiosyncrasies.

The percent time that vehicle noise is audible was retained; it has been the foundation of all NPS noise impact assessments. Peak noise levels were modeled by Hastings et al. (2006), and a very similar metric was retained in this modeling effort. Instead of using the peak noise level, this analysis used the energy average (L_{eq}) of the four loudest noise levels ("peak 4"). This slight modification offered two benefits. First, it reduced the variation in estimated peak level that results from the precise locations that the model happened to select when projecting vehicle noise along a road. Second, it provides an indication of the duration of this high noise level: 15 seconds. The third metric modeled was audibility L_{eq}.

L_{eq} metrics have been extensively studied for more than four decades in relation to transportation noise. The World Health Organization (WHO 1999) recommends that: "Where there are no clear reasons for using other measures, it is recommended that $LA_{eq,T}$ be used to evaluate more-or-less continuous environmental noises." In the quoted text, the "A" refers to A-weighted integration of acoustic power spectra, and the "T" refers to the interval over which energy is averaged. FICON (1992) noted that criticism of L_{dn} (and other L_{eq} metrics) often stems from "lack of understanding of the basis for the measurement, calculation, and application of that metric." Many people have difficulty relating an aggregate of perceived noise events to an average noise level, especially when the time interval for averaging extends over long periods. Hourly, daily, and even annual LA_{eq} metrics have been used by some U. S. Federal Agencies.

The noise models predict when the noise will be audible, so the $LA_{eq,T}$ metric used to support the winter use planning was $LA_{eq,audible}$. Instead of dividing the integrated noise energy by the entire modeling interval (0800-1600), this formula divides the energy by the total time audible. This summary noise level is more readily interpreted: it is the average noise level when the sound can be heard. $LA_{eq,audible}$ does not discount the average level because there are intervals of silence in the modeled day. Therefore, $LA_{eq,\ audible}$ is logically and statistically independent of percent time audible. One metric addresses noise intensity when present; the other addresses how often noise is present. This approach addresses the recommendations of Miller (1999) for NPS noise analyses.

Note that $LA_{eq,8h}$ can be calculated from percent time audible and $LA_{eq,\ audible}$:

$$LA_{eq,\ T} = LA_{eq,\ audible} + 10*\log10(\text{time audible}/T)$$

SCIENTIFIC RATIONALE FOR THE SELECTION OF ACOUSTICAL METRICS FOR WINTER USE ANALYSES

Section 4.9 of the NPS *Management Policies 2006* (NPS 2006) states that the NPS will preserve, to the greatest extent possible, the natural soundscapes of the park, both biological and physical. Natural sounds are intrinsic elements of the environment that are vital to the functioning of ecosystems and can be used to determine the diversity and interactions of species within communities. Soundscapes are often associated with parks and are considered important components of the visitor experience as well as the natural wildlife interactions.

Sound is an intrinsically variable phenomenon that is often described by some basic properties: loudness, timing, pitch. However, the number of potential descriptors is quite large. For example, more than 40,000 measurements per second are required to fully capture the range of sounds audible to humans. The model used to predict noise exposure from winter use in this EIS (NMSim) generates a more compact summary of OSV sounds – 36 measurements per second – but these summaries are still far too complex for NEPA impact analysis. For management purposes, the time history of each OSV noise event is not pertinent. Instead, metrics are needed to concisely represent the aggregate noise exposure generated by each alternative.

In previous NEPA documents, OSV noise has been evaluated in terms of three metrics: the percent time that OSVs are audible, the maximum OSV noise level, and the percent of the park area in which OSV noise was audible. The present analysis retains part of this framework, and extends it to provide additional information. Percent time audible is used, as it has been in the past, to evaluate how often noise intrudes in the natural soundscape. This can be measured by an attentive listener with normal hearing, and it was modeled for this EIS using the NMSim software package. This measure of duration was complimented by a measure of the average loudness of OSV noise when it was audible: “Audible L_{eq}.”

L_{eq} metrics have been the primary means of evaluating community noise since the 1970s (EPA 550/9-94-004: “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate. Margin of Safety”). Virtually all of these metrics, including the metric used here, utilizes an A-weighted filter to sum up all the sound energy across the audible spectrum. The purpose of A-weighting is to add together sound energy across the entire audible spectrum to produce an aggregate measure of perceived loudness. L_{eq} stands for the A-weighted, average squared sound pressure deviations (the sound energy). Many forms of L_{eq} have been used, with one distinguishing feature being the time span over which sound energy is averaged. For the FAA, the primary noise impact metric is DNL (or L_{DN}), which is a 24 hour L_{eq} with a 10 dB_A penalty for noises at night. For Federal Highways, the primary metric is the hourly L_{eq}.

Studies of noise impacts in parks included L_{eq} as one of the metrics used to predict impacts (Anderson et al. 1993; Miller 1999; Rapoza et al. 2005). In the “dose-response” studies conducted at Grand Canyon, Bryce Canyon, Haleakala, and Hawai’i Volcanoes National Parks, L_{eq} referred to the sound energy averaged over the duration of a visit; observers recorded when each visitor entered and exited the study sites. A comprehensive reanalysis of these data (Anderson 2010) revealed that L_{eq} was the most consistent and accurate predictor of annoyance or perceived interference with natural quiet in these surveys. Percent time audible and several other metrics were evaluated in the reanalysis, but they did not perform quite as well across all conditions. A notable feature of the new statistical model is that the magnitudes of park-specific coefficients were dramatically reduced. In contrast to the earlier models (Anderson et al. 1993; Miller 1999; Rapoza et al. 2005), this suggests that the new analysis has revealed a generic predictor of visitor responses, which are much less contingent on the local context.

One difficulty with L_{eq}, especially when it refers to long intervals of time, is that it averages noise energy across the entire interval, which may include substantial periods when no noise is present. In order to address this issue, and produce a summary metric that is more readily interpreted, this EIS uses “Audible L_{eq}.” Audible L_{eq} measures the average noise level when the noise can be perceived by an attentive listener. Intervals of time when no noise is audible are omitted from the calculation. Collectively, Percent Time Audible and Audible L_{eq} provide a direct link to previous L_{eq} metrics: L_{eq} = Audible L_{eq} + 10*log10(Percent Time Audible). This equation provides an opportunity to relate winter use noise impact criteria to the research and standards that addressed community noise impacts.

Combining Percent Time Audible and L_{eq} to analyze noise impacts was recommended more than ten years ago by a noise control expert with extensive experience working in national park settings (Miller 1999). Miller’s paper utilized L_{eq} (aircraft)- L_{eq}(background) in combination with Percent Time Audible, where the averaging time for L_{eq} spanned the duration of a visit. In recent discussions with the Natural Sounds and Night Skies Division, Miller has acknowledged that Audible L_{eq} may be better. Audible L_{eq} is more readily interpreted, because it represents the average level of the noise when it is perceptible. Second, Audible L_{eq} is statistically independent of Percent Time Audible because it is unaffected by periods of silence.

In addition to Percent Time Audible and Audible L_{eq},, one more metric was computed and analyzed for this EIS. Previous analyses used the peak noise level – L_{max} – to assess the most acute noise conditions. The current analysis utilized a very similar metric – Peak 4 – which summarized the L_{eq} of the four loudest noise levels. Peak 4 has two advantages over L_{max}. First, this measurement is highly repeatable in modeling, because it is not sensitive to the timing of a vehicle's movement along a route or the location of the modeled receiver points. Second, this metric also indicates the minimum duration of the loud event. Successive time steps in the Winter Use models were about five seconds apart, so a Peak 4 event had to be at least 15 seconds long.

SCIENTIFIC BASES FOR TRANSLATING METRIC VALUES INTO PLAUSIBLE LEVELS OF IMPACT

Each metric focuses on a particular aspect of noise exposure, deemphasizing or neglecting others. Peak 4 measures the loudest noise events, but does not indicate how often they occur. Peak 4 will not vary among alternatives unless the loudest vehicles in one alternative are completely eliminated from other alternatives; it is insensitive to changes in daily traffic levels. Audible L_{eq} measures how loud noise is on average (when it can be heard), but does not indicate how often it occurs. Audible L_{eq} will not vary among alternatives if the traffic mix does not vary, even if overall traffic levels change. Percent Time Audible measures how often noise is detectable, and it provides a measure of one effect of changing traffic levels. However, it provides no information about how loud the noise is.

L_{eq}, the metric that has been used for most community noise studies, measures total noise energy, regardless of when it occurs and from what source. The numeric value of L_{eq} is difficult to interpret in a park setting, where there are long intervals of silence, but comparisons among L_{eq}

values for different alternatives can be readily translated into changes in effective traffic level. Accordingly, NPS has decided to utilize L_{eq} as an aggregate measure of the effects of OSV traffic as measured by noise level.

For this EIS, an L_{eq} of 35 dB has been selected as the criterion corresponding to a major impact to travel corridor acoustical environments. A variety of authoritative and scientific sources point to 35 dB_A as a pertinent sound level criterion for quiet environments. ANSI Standard 12.2 – Criteria for Evaluating Room Noise – specifies 35 dB_A as the desired background condition for many indoor spaces where quiet and outstanding listening conditions are important (bedrooms, auditoria, theatres, conference rooms). ANSI 12.60 – Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools – specifies 35 dB_A as the background criterion for empty classrooms, recognizing that children are demonstrably less capable of distinguishing speech in noise and that noise affects attention. Note that an L_{eq} of 35 dB can be realized by several combinations of Percent Time Audible and Audible L_{eq}: 50% and 38 dB, 25% and 41 dB, 10% and 45 dB, 1% and 55 dB. Higher intensity exposures can be evaluated as having equivalent impacts to the acoustical environment if the duration of the exposure is shortened sufficiently.

The lesser impact criteria of moderate and minor have been chosen by successive decrements of 10 dB from the major impact criterion: moderate impacts when L_{eq} is greater than 25 dB, minor impacts when L_{eq} is greater than 15 dB. For backcountry settings, the impact criteria are equal to the travel corridor values minus 10 dB: major impacts when L_{eq} is greater than 25 dB, moderate impacts when L_{eq} is greater than 15 dB, and minor impacts when L_{eq} is greater than 5 dB. Note that a 10 dB decrease in noise exposure is equivalent to a tenfold decrease in traffic or a tenfold increase in distance from a straight segment of road. In accordance with recommendations in the NPS VERP Handbook (NPS 1997) and other management guidance, the overall impact determinations for the park incorporate provisions for exceptions. A major impact determination for the travel corridor zone as a whole requires that more than 90% of the zone exceeds an L_{eq} of 35 dB. The backcountry analysis also requires that more than 90% of this zone exceed an L_{eq} of 25 dB to receive an overall assessment of major impact.

Although these impact criteria do not specify pristine acoustical conditions, they are highly protective. The major impact criterion for the travel corridor corresponds to recommendations for quiet indoor environments where good listening conditions are important. For backcountry sites, the major impact criterion would correspond to requirements for recording studios and other indoor settings demanding the lowest possible sound levels (at significant expense). These criteria should also be protective for wildlife. Landon et al. (2003) found that Sonoran pronghorn antelope avoid areas with L_{eq} >55 dB and preferred areas with L_{eq} < 45 dB.

Audible Leq provides an additional basis for relating these impact criteria to a peer-reviewed study. Aasvang and Engdahl (1999) conducted two days of surveys in a park setting near a large airport. On day 1, 10 of 20 subjects found sounds exceeding 60 dB_A to be unacceptable in the park setting. On the second day, 9 of 16 subjects found sounds above 50 dB_A to be unacceptable. In the travel corridor, events exceeding 60 dB_A would have be limited to less than 0.3% of the day, or about one and half minutes in total. Events exceeding 50 dB_A would have be limited to less than 3% of the day, or about fifteen minutes in total. In backcountry sites the allowable durations would be one tenth of these values.

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APPENDIX D: DRAFT NON-IMPAIRMENT DETERMINATION FOR THE NATIONAL PARK SERVICE PREFERRED ALTERNATIVE

DRAFT NON-IMPAIRMENT DETERMINATION FOR THE NATIONAL PARK SERVICE PREFERRED ALTERNATIVE

The National Park Service (NPS) *Management Policies 2006* (section 1.4) require analysis of potential effects to determine whether or not an NPS action would impair a park's resources and values. The preferred alternative identified for managing winter use in the interior of Yellowstone National Park (Yellowstone or the park) is alternative 7.

The fundamental purpose of the national park system, established by the *Organic Act* and reaffirmed by the *General Authorities Act*, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the NPS the management discretion to allow impacts on park resources and values when necessary and appropriate to fulfill the purposes of the park. That discretion is limited by the statutory requirement that the NPS must leave resources and values unimpaired unless a particular law directly and specifically provides otherwise.

NPS *Management Policies 2006* (section 1.4.7.1) also prohibit unacceptable impacts, which are defined as, "impacts that fall short of impairment, but are still not acceptable within a particular park's environment." During the impairment analysis, the preferred alternative was also evaluated for unacceptable impacts. NPS has concluded that for the same reasons no impairment to park resources or values would occur (discussed below), no unacceptable impacts would occur as a result of implementation of the preferred alternative.

Pursuant to NPS *Management Policies 2006,* impairment is an impact that, in the professional judgment of the responsible NPS manager, "would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values." Whether an impact constitutes impairment depends on the particular resources that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.

An impact on any park resource or value may, but does not necessarily, constitute impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; or
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

An impact would be less likely to constitute impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated.

Impairment may result from visitor activities, NPS administrative activities, or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also result from sources or activities outside the park.

For the preferred alternative, a determination of impairment is made for each of the impact topics carried forward for detailed analysis in the environmental impact statement. Pursuant to the *Interim Guidance for Impairment Determinations in NPS NEPA Documents* (NPS 2010), impairment findings are not necessary for visitor experience, health and safety, environmental justice, or park operations because these impact topics are not generally considered to be park resources or values, and are therefore not subject to the written impairment determination requirement found in NPS *Management Policies 2006*. A description of the current state of each of the resource topics evaluated for impairment can be found in "Chapter 3: Affected Environment" of the draft Winter Use Plan / Environmental Impact Statement (plan/EIS).

The park's purpose and significance were considered during the impairment determination process for the preferred alternative. Congress established the park to "dedicate and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people … for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition" (U.S. Congress 1872). The purpose and significance of the park are rooted in its legislation and its natural and cultural resources.

Statements of a park's significance describe why the park is important within a global, national, regional, and ecosystem-wide context and are directly linked to the purpose of the park. Yellowstone National Park is significant for the following reasons:

- It is the world's first national park.
- It preserves geologic wonders, including the world's most extraordinary collection of geysers, hot springs, and the underlying volcanic activity that sustains them. Yellowstone is positioned on a "hot spot" where the earth's crust is unusually thin and molten magma rises relatively close to the surface.
- It preserves abundant and diverse wildlife in one of the largest remaining intact and wild ecosystems on earth, supporting surrounding ecosystems and serving as a benchmark for understanding nature.
- It preserves an 11,000-year continuum of human history, including sites, structures, and events that reflect our shared heritage. This history includes the birthplace of the national park idea—a milestone in conservation history.
- It provides for the benefit, enjoyment, education, and inspiration of this and future generations. Visitors have a range of opportunities to experience the essence of Yellowstone's wonders and wildness in a way that honors the park's value to the human spirit and deepens the public's understanding and connection to it.

The mission statement of Yellowstone National Park follows:

> Preserved within Yellowstone National Park are Old Faithful and the majority of the world's geysers and hot springs. An outstanding mountain wildland with clean water and air, Yellowstone is home of the grizzly bear and wolf and free-ranging herds of bison and elk. Centuries old sites and historic buildings that reflect the unique heritage of America's first national park are also protected. Yellowstone National Park serves as a model and inspiration for national parks throughout the world. The National Park Service preserves, unimpaired, these and other natural and cultural resources and values for the enjoyment, education, and inspiration of this and future generations.

WILDLIFE AND WILDLIFE HABITAT

Wildlife and wildlife habitat are necessary to fulfill the purposes for which Yellowstone was established. Wildlife and its habitats are vital components of the Yellowstone ecosystems identified in the park's purpose and significance statements, as well as the mission statement. Yellowstone provides winter habitat for many terrestrial wildlife species. Winter use of the park by ungulates such as elk and bison is widespread, and herds of these large ungulates are focal points for visitors. Elk and bison, identified during scoping as species that could be affected by winter use, have been the subject of numerous studies related to motorized oversnow vehicle (OSV) and non-motorized uses. In addition to elk and bison, three species listed or treated (they are species of special concern in the park) as threatened under the Endangered Species Act that could be impacted by OSV use are Canada lynx (*Lynx canadensis*), grizzly bears, and gray wolves. However, due mainly to their hibernation patterns and late season closure of the park's backcountry, grizzly bears are unlikely to experience adverse effects from winter use and were therefore not carried forward for detailed analysis in the draft plan/EIS (see "Issues and Impact Topics Considered but Dismissed from Further Analysis" (page 11 in chapter 1 of the draft plan/EIS).

Winter use, as proposed under the preferred alternative, will have some effects on wildlife, just like every other form of visitor access to the park. However, only minor to moderate impacts to wildlife are expected to result from implementation of the preferred alternative. Extensive studies of the behavioral responses of the species evaluated (elk, bison, wolves, lynx, wolverines, trumpeter swans, and eagles) to over snow traffic showed that these animals rarely showed high-intensity responses (movement, defense postures, or flight) to approaching vehicles. Non-motorized use has also shown some minor effects. The responses that do occur do not rise to the level of the "taking" or disturbance that is prohibited by NPS regulations. More than 35 years of census data do not reveal any relationship between changing winter use patterns and elk or bison population dynamics. No wildlife populations are currently declining due to winter use (swan populations are declining, but this decline is being experienced regionally and due to factors unrelated to winter use in the park or region). In fact, during the last decade or more, motorized oversnow vehicle use levels have been equal to and higher than those called for under the preferred alternative, and populations of species such as grizzly bears and wolves have increased dramatically (USFWS 2010; Smith et al. 1998, 2005, 2006, 2007).

Under the preferred alternative, motorized oversnow vehicle use would be well below levels previously studied by NPS wildlife biologists and well within the limits discussed by those studies and the Scientific Assessment of Yellowstone National Park Winter Use prepared during this EIS process. Based upon this information, there is no reason to suspect that winter use at the proposed levels under the preferred alternative would pose a risk of impairment to any wildlife. All visitors using motorized oversnow vehicles would travel with commercial guides, thus reducing or even eliminating altogether any chances of wildlife harassment. Impact analysis in the draft plan/EIS clearly demonstrates that the preferred alternative will not interfere with wildlife ecology for any species. If the preferred alternative is implemented, the park would meet its mission of preserving these natural resources and associated values unimpaired, and retain its significance in the overall conservation of abundant and diverse wildlife in one of the largest remaining intact and wild ecosystems on earth, supporting surrounding ecosystems and serving as a benchmark for understanding nature.

For all species carried forward for detailed analysis, impacts from the implementation of the preferred alternative include potential displacement of individual animals, potential behavioral and physiological responses of individual animals, and potential small-scale, local population-level impacts. However, in each instance, impacts from motorized oversnow vehicles and non-motorized users would be relatively low, as disclosed in the draft plan/EIS (see chapter 4, pages 187–243). The vast majority of wildlife numbers and habitat would remain intact to allow both individuals and populations to flourish. Therefore, no wildlife or wildlife habitat would be impaired as a result of the implementation of the preferred alternative.

BISON AND ELK

Scientists have not observed any large-scale shifts in habitat use due to the presence of OSVs, skiers, or snowshoers in the park. A small percent of both bison and elk have demonstrated limited flight responses from OSVs or skiers and avoidance of OSV use areas, resulting in small-scale and temporary shifts in habitat use by bison or elk (White et al. 2008). However, even with the projected level of impact, the impacts to individual elk and bison would be short-term and localized, and impacts to elk and bison populations would be barely noticeable over the long term, if at all. Impacts would occur to relatively few individuals, and the vast majority of wildlife numbers and habitat would remain intact to allow both individuals and populations to flourish. Elements of the preferred alternative such as the commercial guiding requirement, variable use levels that allow for lower use during the season than seen in recent years, and the requirement for Best Alternative Technology (BAT) OSVs would further ensure that impacts to the park’s bison and elk remain minor.

LYNX AND WOLVERINES

Adverse impacts of the preferred alternative on lynx and wolverine would be localized and short-term, and would be mitigated through OSV management measures that include a two-week closure of Sylvan Pass at the end of the winter season, which is the critical breeding periods for these species. Use across Sylvan Pass would be quite low – about five OSV groups per day and only an occasional skier. Impacts would occur to relatively few individuals, and the vast majority of wildlife numbers and habitat would remain intact to allow both individuals and populations to flourish.

The preferred alternative would continue the operation of Sylvan Pass, the closest OSV route to prime lynx and wolverine habitat in the eastern sector of the park. The end of season closure of the east entrance and east side road would reduce the impacts of OSVs on wolverines in the area, but OSV use would still overlap with the breeding season by about two weeks. Effects resulting from OSVs on the Sylvan Pass road and maintenance activities could have a minor impact on reproductive success of denning wolverine females, but no injury or mortality to wolverines would occur as a result of implementation of the preferred alternative.

Impacts to lynx could occur because their mating season also overlaps OSV use in the park by about 2 weeks, and roaming lynx travel may be limited by groomed roads necessary for OSV use. Again, the low level of winter use and the early closure of the East Entrance to OSV use (March 2 to 15), would minimize OSV impacts to lynx in this area, but lynx traveling between territories may still be affected by OSV use in the park. No injury or mortality to lynx would occur as a result of implementation of the preferred alternative.

TRUMPETER SWANS AND EAGLES

Impacts to trumpeter swans and eagles would occur to relatively few individuals, and the vast majority of wildlife numbers and habitat would remain intact to allow both individuals and populations to flourish. While trumpeter swan populations are declining in the park, there are successful swan breeding territories near motorized routes in the greater Yellowstone area outside Yellowstone (McEneaney 2006), and winter use has not been shown to be the primary factor in the decline of the resident swan population (Proffitt et al. 2009).

Behavioral observations under recent use levels at or above the levels proposed under the preferred alternative show limited displacement and few energetically costly behavioral responses, which would likely limit physiological responses in swans and eagles (Hardy 2001; White et al. 2008). Therefore a majority of both swans and eagles are expected to demonstrate limited responses to OSVs and non-motorized users under the use limits proposed for the preferred alternative. Impacts on swans and eagles under would be localized and short-term, resulting in impacts to relatively few individuals. No injury or mortality to trumpeter swans or eagles would occur as a result of implementation of the preferred alternative. Impacts would range from not observable or measureable to impacting relatively few individuals. No injury or mortality to trumpeter swans or eagles would occur as a result of implementation of the preferred alternative.

GRAY WOLVES

Impacts to wolves under the preferred alternative would be rare, localized, and short-term. In recent years, motorized OSV use has been at or above levels proposed in the preferred alternative. During this time, winter road monitoring crews have rarely observed behavioral responses by wolves to OSVs in Yellowstone, due to infrequent encounters, with a total of only 14 sightings of wolf-OSV interaction over 7 winter monitoring seasons. Wolves appear to avoid interaction with OSV users, and there is no evidence from wolf territories in the park of large-scale displacement or habitat avoidance (Smith et al. 2005). Wolf tracks were frequently observed on roads at night, suggesting that wolves travel on roads during that time to conserve energy but avoid OSV activity (Smith et al. 2005; Smith et al. 2006). Extensive wolf-watching occurs in the northern portions of the park with no apparent effect on wolves. Wolf populations in the park have grown during periods of much higher OSV use than those proposed under the preferred alternative (Smith et al. 1998, 2005, 2006, 2007). Overall, impacts to gray wolves would be barely noticeable, if at all, and the vast majority of wolf numbers and habitat would remain intact to allow both individuals and populations to flourish.

AIR QUALITY

The park is classified as a Class I area. Class I areas are those where Congress enacted a special “visibility protection” measure for the statutory Class I areas where visibility is an “important value” (NPS 2005b). Maintaining the park’s air quality is necessary to fulfill the purposes for which Yellowstone was established. The importance of air quality in Yellowstone can be seen in its significance and mission (both stated above). The ability of Yellowstone to provide for “the benefit, enjoyment, education, and inspiration of this and future generations” and for visitors to experience the essence of the park’s wonders and wildness is achieved, in part, by the air quality maintained within the park. The importance of air quality is further noted in the park’s mission, which describes the park as “an outstanding mountain wildland with clean water and air.” Both monitoring of recent use levels at or above the levels proposed under the preferred alternative and modeling of the preferred alternative reveal that under the preferred alternative, air quality, in the park, including visibility, would remain very good.

Adverse impacts of the preferred alternative to air quality in the park would be minor and long-term, and would be mitigated though OSV management measures that include the requirement for BAT for snowcoaches as well as continuing and strengthening the BAT requirements for snowmobiles. Modeling has shown that impacts to air quality would be the same, regardless of the variation in use proposed under the preferred alternative. Under alternative 7a (high use), the minor adverse impacts are due to the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 1.5 ppm, 0.4 ppm, and 0.032 ppm, respectively. Under alternative 7b (medium use), the minor adverse impacts are due to the predicted maximum 1-hour CO, 8-hour CO, and 1-hour NO_2 concentrations of 0.7 ppm, 0.3 ppm, and 0.029 ppm, respectively. Under alternative 7c (low use), the minor adverse impacts are due to the predicted maximum 1-hour CO and NO_2 concentrations of 0.4 ppm, and 0.008 ppm, respectively.

Under the preferred alternative, no perceptible visibility impacts are expected. Motorized OSV use would result in emissions that are well below all regulatory standards, never rising to more than 50% of the National Ambient Air Quality Standards for each pollutant, and would constitute a level of air quality that would allow the park to maintain its significance and meet its mission of providing enjoyment of the clean mountain air. Therefore, there is no reason to suspect that winter use at the proposed levels under the preferred alternative would pose a risk of impairment to the park's air quality.

SOUNDSCAPES

The soundscape at Yellowstone includes both natural and human components. The "natural quiet" that occurs in the absence of human sound sources is also defined as the "natural ambient" sound level of a park. These natural ambient sound conditions exist in the absence of any human produced noises. Common natural ambient sounds at Yellowstone include bird and animal calls, running water, wind, and thermal activity (e.g., geysers and hot springs). Non-natural sounds include those produced by snowmobiles, snowcoaches, snow groomers, aircraft, human voices, wheeled vehicles and building operations (Burson 2009). These sounds may be heard as a composite of sound, not individually. Like air quality, the soundscapes in the park are a component of the essence of Yellowstone's wonders and wildness that contribute to the park's significance. In addition, the retention of the natural curiosities and wonders within Yellowstone, the reason why the park was established, includes retaining natural sounds.

Under the preferred alternative, impacts to soundscapes would result from both administrative and visitor OSV use. Impacts to soundscapes from this use would be long-term but localized to the travel corridors themselves, with some sound from motorized OSV use detectable in the backcountry area immediately adjacent to the travel corridors. Winter silence would predominate away from developed areas and road corridors, and would exist for large portions of the day along many of the travel corridors.

The preferred alternative calls for sound levels that provide for times of quiet and large periods of the day that are below 35 decibels, which is a desired background level for empty classrooms and auditoria, where quiet and outstanding listening conditions are important. Under the preferred alternative, visitors would have the opportunity to experience natural sounds including the ability to hear clearly the delicate and quieter intermittent sounds of nature, the ability to experience interludes of extreme quiet for their own sake, and the opportunity to do so for extended periods of time. The park would be able to provide for visitor enjoyment of its soundscape wonders and wildness, and therefore there is no reason to suspect that winter use at the proposed levels under the preferred alternative would pose a risk of impairment to the park's soundscapes.

CONCLUSION

In the best professional judgment of the NPS decision-maker, based upon the impact analysis in the draft plan/EIS, relevant scientific and scholarly studies, advice or insights offered by subject matter experts and others who have relevant knowledge or experience, and the results of civic engagement and public involvement activities, that no impairment of park resources or values would result from implementation of the preferred alternative.

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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