National Park Service • U.S. Department of the Interior

Petrified Forest National Park

Wilderness Stewardship Plan/Environmental Assessment

February 2013

Watercolor landscape cover inspired from photograph by Daniel Mosquin.

WILDERNESS STEWARDSHIP PLAN
ENVIRONMENTAL ASSESSMENT

Petrified Forest National Park
Apache and Navajo Counties, Arizona

Petrified Forest National Park is in northeastern Arizona, about 100 miles east of the city of Flagstaff. The park wilderness area was designated by Congress in 1970 (84 Stat. 1105, Section 2b) and includes two separate units—the north wilderness unit, in the Painted Desert, and the south wilderness unit, located along Puerco Ridge, east of Rainbow and Crystal Forests. The total combined acreage of the two wilderness units is 51,728 acres. The wilderness area exhibits outstanding geological resources with exposed, fossil-rich Chinle Formation layers dating to the Late Triassic period. Archeological resources document over 10,000 years of human presence in the area. Self-reliant visitors seeking a primitive, unconfined recreational experience encounter an expansive landscape of rugged natural beauty.

The purpose of this Wilderness Stewardship Plan is to guide the preservation, management, and use of park wilderness to ensure that it remains unimpaired for future use and enjoyment. The overarching goal of the plan is to restore, protect, and enhance wilderness character. The Wilderness Stewardship Plan is needed to replace the park's 1979 backcountry management plan and will be consistent with the 1993 general management plan (revised 2004, amended 2010).

This document describes two alternatives for managing Petrified Forest National Park wilderness units. The environmental impacts associated with implementation of the alternatives have been assessed. The no-action alternative (alternative A) describes continuation of existing management and serves as a basis of comparison for the action alternative (alternative B, the preferred alternative). Under the no-action alternative, the National Park Service (NPS) would respond to future wilderness management needs and conditions in accordance with all applicable laws and policies, but would not implement changes that substantially depart from current actions, programs, and plans.

Under alternative B, the National Park Service would adopt a proactive, comprehensive approach to wilderness management, employing a variety of strategies to protect and enhance wilderness character. Backcountry management issues would be addressed, particularly with regard to visitor access of the north wilderness unit from locations outside the wilderness boundary. Desired resource conditions and visitor experience for the wilderness area would conform to those presented in the 2004 General Management Plan Revision for the "preservation emphasis zone." Natural processes would prevail, natural landscapes and soundscapes would predominate, and evidence of recreational uses would not be readily apparent. Visitors would have opportunities for solitude, independence, and adventure and would rarely encounter other visitors or park staff. NPS management activities include research and monitoring, occasional administrative use, and protection of natural and cultural resources. Management activities would be consistent with NPS servicewide wilderness management policies.

The key impacts of implementing the alternatives are described in "Chapter 4: Environmental Consequences" and are summarized in table 5.

This document has been distributed to agencies, associated tribes, and other interested organizations and individuals for their review and comment. The public comment period for this document will last for 30 days after it is published and distributed. Please note that NPS practice is to make comments, including names and addresses of respondents, available for public review. Please see "How to Comment on this Plan" discussed on the next page for further information.

HOW TO COMMENT ON THIS PLAN

Comments on this plan are welcome and will be accepted for 30 days after this document has been published and distributed. Comments/responses may be submitted, either electronically (over the Internet) or in writing. Commenters are encouraged to use the Internet if at all possible. Please submit only one set of comments.

To ensure you are included in our mailing list, please include your name and address on any correspondence.

Internet comments can be submitted at: http://parkplanning.nps.gov/PEFOWSP. Select "Open for Comment" and then "Comment on Document."

Written comments may be sent to:

Superintendent
Petrified Forest National Park
PO Box 2217
Petrified Forest, AZ 86028

Before including your address, telephone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. Although you can ask the National Park Service to withhold your personal identifying information from public review, the National Park Service cannot guarantee your request will be granted.

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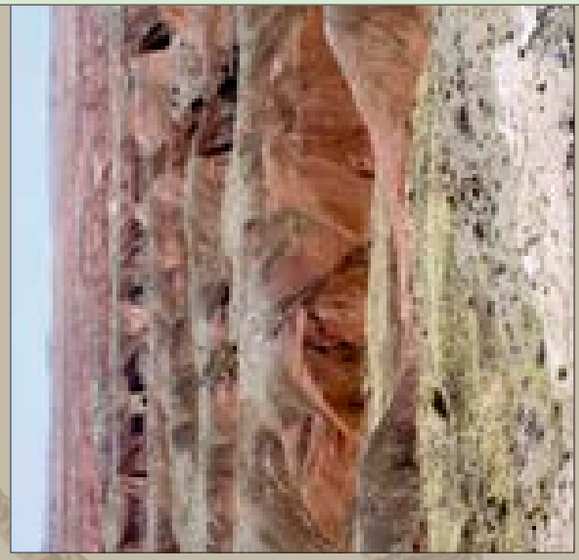


INTRODUCTION

PARK OVERVIEW

Petrified Forest National Park is in north-eastern Arizona in a remote, arid, and sparsely populated area, about 100 miles east of Flagstaff and 27 miles east of the gateway city of Holbrook. The park contains one of the largest and most colorful concentrations of petrified wood in the world, as well as multi-hued badlands of the Chinle Formation, portions of the Painted Desert, historic structures, petroglyphs, archeological sites, and wildlife. Vegetation in the park is varied and includes grasslands, desert plant communities, and shrublands.

The park is bounded by the Navajo Indian Reservation to the north and by private lands, state lands, and U.S. Bureau of Land Management (BLM) lands to the south, east, and west. Several other Indian reservations and national forests are nearby. Most of the adjacent land has been managed as part of large cattle ranches for the past 120 years.

PARK WILDERNESS AREA OVERVIEW

On October 23, 1970, Congress designated the Petrified Forest National Park Wilderness Area (84 Stat. 1105, Section 2b) and includes two separate units—the north wilderness unit, in the Painted Desert, and the south wilderness unit, located along Puerco Ridge, east of Rainbow and Crystal Forests. Along with a portion of lands in Craters of the Moon National Monument, the act established these units as the first wilderness areas in the national park system—38% of the park's 134,523 acres is designated wilderness. The "Wilderness Area" map on the next page shows the location of the park's two wilderness units. Although not shown on the map, the park boundary around both wilderness units is fenced to prevent trespass by livestock and all-terrain vehicles (ATVs).

The north wilderness unit of the park provides visitors with unparalleled opportunities to experience vast, rugged landscapes, natural soundscapes, and superb dark night skies. With its lack of trails, signs, and other developments, the wilderness provides the epitome of primitive, unconfined recreation for the most self-reliant of visitors. The high desert grasslands found here support an intact ecosystem that is home to a variety of keystone species such as pronghorn, mule deer, and prairie dogs. The wilderness also includes some of the best exposed layers of the Chinle Formation found in the world. These geologic layers tell a significant story about the park from 216 to 205 million years ago. It is one of the best places in the world to study the Late Triassic epoch because the geology is exposed, continuous, and fossil rich. The rocks also record climate change from a tropical to a more arid environment and the subsequent response of plants and animals. Scientists from around the world come to the park to study the remains of the flora and fauna.

The south wilderness unit contains even older exposures of rock dating back 219 to 216 million years ago. Like the north wilderness unit, this area has great scientific value because it records a major extinction event of Late Triassic flora and fauna. Paleontologists find two to three new extinct species of animals each year and many clues to life during the dawn of the age of dinosaurs. In addition to natural resources, the wilderness includes nationally significant archeological resources. Archeologists have found evidence of human occupation spanning over 10,000 years, and are continually making new discoveries about the people and their lifeways. Visitors to this wilderness unit have the opportunity to experience what life might have been like for the ancient people that first inhabited the area.

Since congressional designation in 1970, the use of geographic information system (GIS) technology has improved the accuracy of mapping the wilderness area. As a result, the acreage calculations for the two wilderness units are different than the 50,260 total acres stated in the enabling legislation. Table 1 provides a summary of acres by wilderness unit.

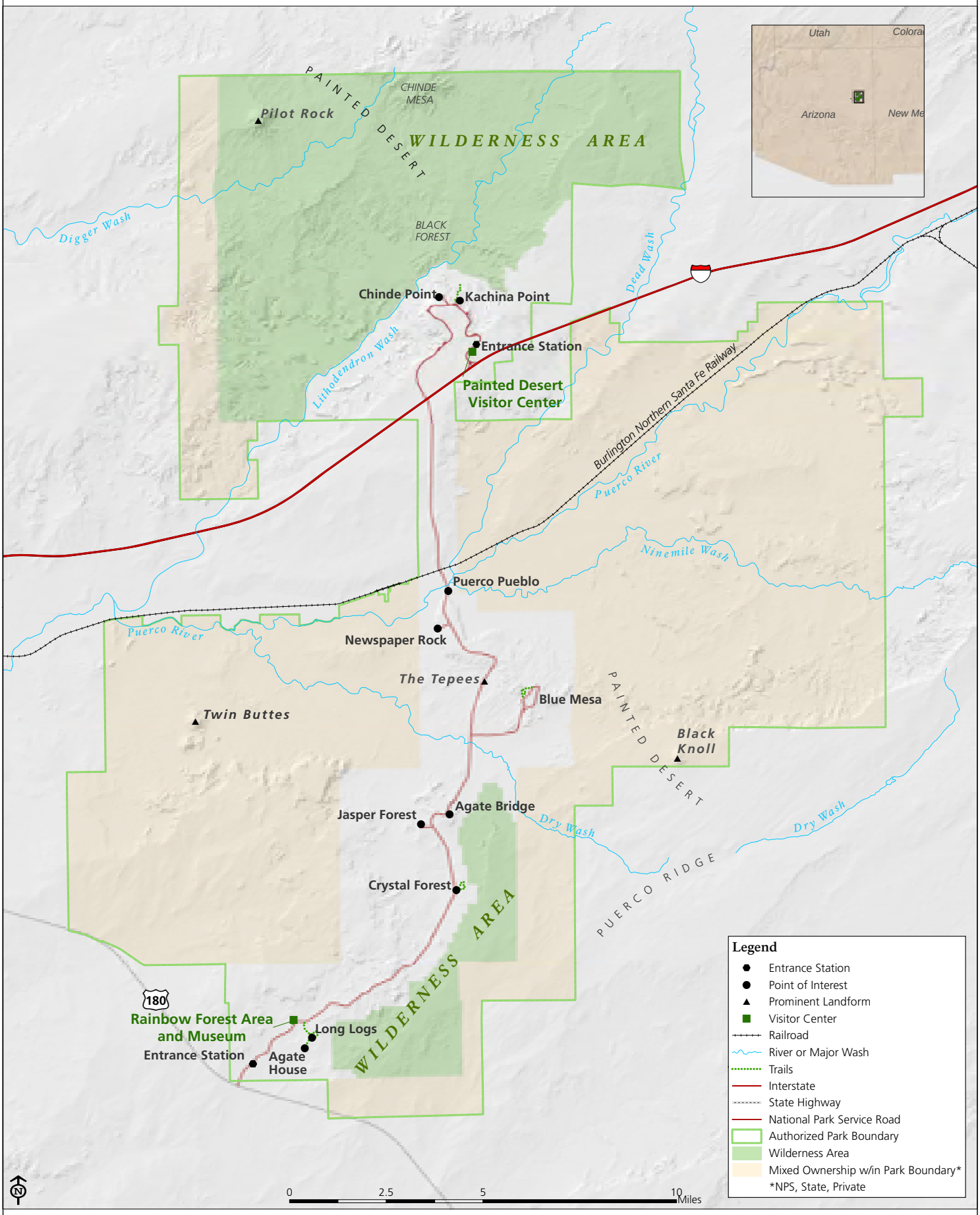
TABLE 1. WILDERNESS UNIT BY ACRE

	Acres	Percentage
North Wilderness Unit	43,526	84%
South Wilderness Unit	8,202	16%
Total	**51,728**	**100%**

Petrified Forest National Park
Arizona

National Park Service
U.S. Department of the Interior

Wilderness Area



Produced by: NPS Denver Service Center Planning Division

Date : October, 2012

BACKGROUND FOR THE PLANNING EFFORT

PURPOSE AND NEED FOR THE WILDERNESS STEWARDSHIP PLAN

The purpose of this Wilderness Stewardship Plan is to guide the preservation, management, and use of park wilderness to ensure that it remains unimpaired for future use and enjoyment. National Park Service (NPS) policy directs the plan to include "desired future conditions, as well as establish indicators, standards, conditions, and thresholds beyond which management actions will be taken to reduce human impacts to wilderness resources." The overarching goal of the plan is to restore, protect, and enhance overall wilderness character.

In 1979, Petrified Forest National Park completed a backcountry management plan for park wilderness and backcountry areas. This backcountry management plan is now outdated and does not adequately address protection of the area's five wilderness qualities that are essential to effective wilderness management. The Wilderness Stewardship Plan is needed to replace the backcountry management plan, while ensuring consistency with the existing general management plans of the park (1993, revised 2004, amended 2010).

PURPOSE AND SIGNIFICANCE OF PETRIFIED FOREST NATIONAL PARK

The purpose and significance of Petrified Forest National Park affects and helps guide management of the park wilderness area. The purpose of the park is to

> preserve, protect, and provide opportunities to experience globally significant Late Triassic paleontological resources, nationally significant archeological sites, and scenic and natural resources, including the Painted Desert, and to foster scientific research and public understanding and appreciation of park resources (NPS 2010).

An abridged list of the significance statements that apply to the park and the wilderness area includes the following:

- Petrified Forest National Park is one of the first national parks to have lands designated as part of the national wilderness preservation system. The park offers opportunities to experience an unusual variety of resources in an undeveloped setting, as well as exceptional challenge and solitude.
- The exceptionally clear air and expansive, colorful landscapes . . . create distinctive scenic vistas.
- Petrified Forest National Park provides, on a variety of levels from easy to challenging, unparalleled opportunities for visitors to experience a colorful and scientifically important petrified forest in its natural setting; archeological resources illustrating people living in demanding environments; the expansiveness, wilderness, and solitude of the Painted Desert; and watching pronghorn and other wildlife of the shortgrass prairie.
- The area of Petrified Forest National Park has been a research laboratory for more than 150 years for paleontology, more than 100 years for archeological study, and more recently for other sciences. Petrified Forest National Park contains a complex array of archeological resources, including petroglyphs, that illustrate a 10,000-year continuum of human land use . . . Shifting cultural boundaries in this area created a high diversity of cultural sites and features still

important to modern American Indians of the region. Late Triassic fossil floras and faunas preserved at Petrified Forest National Park are globally significant because they provide a distinct record of diverse terrestrial ecosystems of approximately 214 and 225 million years ago. The park contains one of the largest and most colorful deposits of mineralized wood in the world.

- Petrified Forest National Park contains some of the best exposures of Late Triassic terrestrial rocks and strata in the world. The Chinle Formation in the park preserves a variety of strata that represent ancient sedimentary environments . . . and their relationships to each other.
- Petrified Forest National Park contains the largest example of recovering native grassland in the southern Colorado Plateau region.

(For more details on the significance of the park and its fundamental resources and values, see NPS 2006c.)

LEGAL AND POLICY REQUIREMENTS

Many federal laws and NPS policies guide wilderness planning and management, therefore forming the basis for the Wilderness Stewardship Plan. The following summarizes the key laws and policies governing management of and planning for the park wilderness area.

The Wilderness Act of 1964 (Public Law [PL] 88-577, 16 *United States Code* [USC] 1131 et seq.) establishes a policy for the enduring protection of wilderness resources for public use and enjoyment. The act defines wilderness as . . .

> . . .a tract of undeveloped federal land of primeval character without permanent improvements or human habitation; an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain; where the forces of nature predominate and the imprint of human activities is substantially unnoticeable; which provides outstanding opportunities for solitude or a primitive and unconfined type of recreation.

This act established the national wilderness preservation system, and set forth management directives that specify the preservation of wilderness character. Section 4 of the act identifies appropriate uses and prohibited uses in wilderness areas.

The National Environmental Policy Act of 1969 (NEPA) (PL 91-190, 42 USC 4321 et seq.) establishes "a national policy which will encourage productive and enjoyable harmony between man and his environment." NEPA requires all government agencies to develop procedures that ensure open and honest documentation of existing resources and potential effects to these resources as a result of the proposed action. NEPA fosters public involvement as a key element of the decision-making process. NEPA compliance procedures are described in NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making*. National Park Service guidance outlines several options for meeting the requirements of the act, depending on the severity of the environmental impacts of the alternatives. An environmental assessment was determined to be the most appropriate instrument for this Wilderness Stewardship Plan, based on a number of considerations. There is no apparent controversy surrounding this planning effort, and the agency's preferred alternative is not expected to have major (significant) effects on the environment or cause impairment of park resources and values. Most adverse impacts of the NPS preferred alternative are anticipated to be negligible or minor in intensity.

The Endangered Species Act of 1973 (16 USC 1531–1543) requires federal agencies to ensure that management activities authorized, funded, or carried out by the agency do not jeopardize the continued existence of listed endangered or threatened species, or result in the destruction or adverse modification of habitat that is critical to the conservation of the species.

Laws and Policies for Cultural Resources Management in Wilderness. Provisions of the Wilderness Act specify that designation of any park system areas as wilderness "shall in no manner lower the standards evolved for the use and preservation of" such units in accordance with other applicable laws (16 USC 1133[a][3]). Consequently, the laws pertaining to the preservation of the nation's cultural heritage (e.g., National Historic Preservation Act of 1966, as amended (16 USC 470), Archaeological Resources Protection Act) remain applicable within wilderness, but are carried out using management methods that are consistent with the preservation of wilderness character and values (NPS *Management Policies 2006* [6.3.8]; Director's Order 41: *Wilderness Stewardship* [6.9]). The *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* continue to provide guidance and direction for the protection and maintenance of historic properties in wilderness areas. However, cultural resource management activities (e.g., inventory, monitoring, treatment, and research) conducted in wilderness must also comply with Wilderness Act provisions with regard to access and use of the minimum requirements concept.

The National Historic Preservation Act of 1966, as amended (16 USC 470) established a comprehensive program to preserve the historical and cultural foundations of the nation as a living part of community life. Section 110 of the National Historic Preservation Act delineates broad historic preservation responsibilities for federal agencies, such as the National Park Service, to ensure that historic preservation is fully integrated into all ongoing programs. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties that are either listed in or eligible to be listed in the National Register of Historic Places (NRHP). The national register includes districts, sites, buildings, structures, and objects important for their significance in U.S. history, architecture, archeology, engineering, and culture. The goal of the section 106 review process is to seek ways to avoid, minimize, or mitigate any adverse effects to historic properties that are listed in or eligible for listing in the national register. Actions proposed for park wilderness units that have the potential to affect cultural resources will be assessed and only undertaken after appropriate section 106 consultations with the Arizona State Historic Preservation Office(r) (SHPO); associated tribal historic preservation officers; other interested agencies, organizations, and individuals; and, as necessary, the Advisory Council on Historic Preservation.

American Indian Religious Freedom Act of 1978 (PL 95-341; 92 Stat. 469; 42 USC 1996) determines that the policy of the United States is to "protect and preserve for American Indians their inherent right of freedom to believe, express and exercise the traditional religions of the Native Americans, including but not limited to site access, use and possession of sacred objects and the freedom to worship through ceremonial and traditional rites."

Archaeological Resources Protection Act of 1979 (PL 96-95; 93 Stat. 712) provides for the protection of archeological resources on public and tribal lands. It requires permits for the excavation and removal of archeological resources; establishes penalties for violators; provides for the preservation and custody of excavated materials, records, and data; provides for confidentiality of archeological site locations; and encourages cooperation with other parties to improve protection of archeological resources.

Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 104 Stat. 3049) assigns ownership or control of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony that are excavated or discovered on federal or tribal lands to lineal descendants, affiliated Indian tribes or Native Hawaiian organizations. Among its provisions, the act establishes criminal penalties for trafficking in human remains or cultural objects, and requires federal agencies and museums receiving federal funding to inventory Native American human remains and associated funerary objects in their possession or control and to identify their cultural and geographical affiliations.

Executive Order 13007, "Indian Sacred Sites," May 24, 1996 (61 *Federal Register* 26771) instructs all federal land management agencies (to the extent practicable, permitted by law, and not inconsistent with essential agency functions) to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites.

The National Park Service Organic Act of 1916 (16 USC 1a-1) created the National Park Service and established its purpose: ". . . to conserve the scenery and the natural and historic objects and the wild life 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." The act directs the National Park Service to promote and regulate the use of the parks by such means and measures as conform to their fundamental purposes. Congress and the courts have interpreted this act with clarification that "when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant" (NPS 2000, 1.4.3).

NPS *Management Policies 2006* establishes servicewide policies for preservation, management, and use of park resources and facilities, and establishes direction for the management of NPS wilderness. Section 6.1 states: "The National Park Service will manage wilderness areas for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness. Management will include the protection of these areas, the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness. The purpose of wilderness in the national parks includes the preservation of wilderness character and wilderness resources in an unimpaired condition and, in accordance with the Wilderness Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use." More specific guidelines for application of the Wilderness Act in national park units are described in chapter 6 of NPS *Management Policies 2006*, including wilderness resource management, wilderness planning, wilderness use, and public education.

NPS Director's Order 41 and Reference Manual 41: *Wilderness Preservation and Management* (1999) provide clarification and interpretation of NPS wilderness policies and establish specific guidelines to provide accountability, consistency, and continuity to the NPS wilderness management program. Topics include wilderness management planning, management techniques, minimum requirement concept, interagency coordination, interpretation and education, scientific activities, facilities, signs, fire management, cultural resources, general public use, use by persons with disabilities, commercial services, special events, air quality, mineral development, and training requirements.

RELATIONSHIP TO OTHER PLANS

Backcountry Management Plan (1979)

The wilderness area of the park is currently being managed under direction of the Backcountry Management Plan (1979). This

plan is largely outdated because it does not adequately address protection of wilderness character. The Wilderness Stewardship Plan will replace the existing backcountry management plan; however, relevant management strategies and effective regulations from the backcountry management plan will be carried forward in the new plan, as appropriate.

General Management Plans

Overarching management direction for Petrified Forest National Park is provided in three general management plans. Overarching management direction for Petrified Forest National Park is provided in three general management plans. This Wilderness Stewardship Plan ensures consistency with these general management plans, while expanding on guidance related to wilderness protection.

General Management Plan (1993, revised 2004). The park's first general management plan was completed in 1993 and provides direction for managing the pre-expansion portion of the park. Much of this plan is still valid, although certain portions were reconsidered in the 2004 *General Management Plan Revision / Environmental Impact Statement*, including the park's foundation statement and an approved set of management zones. Both wilderness units are within the preservation emphasis zone. The wilderness stewardship plan would adopt the desired resource conditions and visitor experience of this zone in order to ensure consistency with the direction set forth in the general management plan.

General Management Plan Amendment (2010). The 2010 General Management Plan Amendment sets forth interim management direction for newly acquired lands within the expanded boundary of the park. The plan amendment states that a wilderness study for the added lands has been deferred until a substantial portion of private lands has been acquired. Ideally, the wilderness study would be conducted in combination with a future comprehensive general management plan for the expanded park.

WILDERNESS STEWARDSHIP FRAMEWORK

The new NPS wilderness stewardship framework includes a number of key components that have been integrated into this planning effort. These include wilderness character narratives, a baseline condition assessment, goals, standards, monitoring, and management actions.

Wilderness character is the framework's unifying element and the foundation for all management decisions proposed in this plan. Wilderness character is defined as the combination of biophysical, experiential, and symbolic ideals that distinguishes wilderness areas from other land. These ideals combine to form a complex and subtle set of relationships among the land, its management, its users, and the meanings people associate with wilderness. In total, these relationships and meanings are described as "wilderness character." Because wilderness character is unique to each wilderness area, narratives that describe the distinctive character of the wilderness area of the park have been prepared as part of this plan.

The next key component of the framework includes an assessment of the five qualities of wilderness character. This includes general status, trends, and issues and threats to the park wilderness area. Desired conditions for each wilderness quality are also described, which is the basis for developing the goals, objectives, and strategies for this plan.

A comprehensive monitoring strategy is another critical part of the wilderness stewardship framework. This monitoring strategy is intended to track trends in wilderness character by developing a set of indicators and measures for each wilderness quality. Indicators and measures are designed to track conditions to assess progress toward attaining desired conditions and preserving wilderness character. Standards and thresholds are based on the measures and developed to ensure that trends are stable or improving over time.

The final piece of the framework includes two types of management actions: (1) those that could be implemented immediately following approval of this plan (to achieve the preferred alternative's overall management concept), and (2) those that are implemented if a standard or threshold for a resource condition is exceeded (based on the results of ongoing monitoring).

Combined, these components form the basis of this planning effort and the overall organization to the document. Figure 1 illustrates this wilderness stewardship framework:

NEXT STEPS

After distribution of the Wilderness Stewardship Plan / Environmental Assessment (the plan), there will be a 30-day public review and comment period, after which the National Park Service will evaluate comments from other federal, state, and local agencies; organizations; businesses; and individuals regarding the plan. If appropriate, changes would then be incorporated into a finding of no significant impact (FONSI), which documents the NPS selected alternative for implementation. In addition, the FONSI would include any necessary errata sheet(s) for factual changes required in the document, as well as responses to substantive comments by agencies, organizations, or the public. Once the FONSI is signed by the NPS regional director, and following a 30-day waiting period, the plan can be implemented. If a finding of no significant impact is found not to be appropriate, the National Park Service would publish a notice in the *Federal Register* of the intent to prepare an environmental impact statement.

FIGURE 1. WILDERNESS STEWARDSHIP FRAMEWORK

IMPLEMENTATION OF THE PLAN

The approval of this plan does not guarantee that the funding needed to implement the plan will be forthcoming. The implementation of the approved plan will depend on future funding, and it could also be affected by factors such as changes in NPS staffing, visitor use patterns, and unanticipated environmental changes. Full implementation could be many years in the future. Once the plan has been approved, additional feasibility studies and more detailed planning, environmental documentation, and consultations would be completed, as appropriate, before certain actions in the selected alternative can be implemented.

WILDERNESS CHARACTER—A FOUNDATION FOR PLANNING AND MANAGEMENT

The foundation for preparing a Wilderness Stewardship Plan is to clearly articulate the five qualities of wilderness so that these qualities can be protected in accordance with the mandate of the Wilderness Act. These qualities include (1) untrammeled, (2) natural, (3) undeveloped, (4)solitude or primitive and unconfined recreation, and (5) other features and values—which together are referred to as wilderness character.

Principle tools for developing wilderness character narratives include *Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System* and *Keeping it*

Wild in the National Park Service: A User Guide to Integrating Wilderness Character and Park Planning, Management, and Monitoring (hereafter *Keeping it Wild*) (USDA 2008; NPS 2012). This guidance interprets the congressional intent of the concept of wilderness character in the 1964 Wilderness Act to identify five qualities that are relevant and practical to wilderness stewardship. A definition for each of these wilderness qualities follows.

Untrammeled

The Wilderness Act states that wilderness is "an area where the earth and its community of life are untrammeled by man," and "generally appears to have been affected primarily by the forces of nature." In short, wilderness is essentially unhindered and free from modern human control or manipulation. This quality is degraded by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness area.

Natural

The Wilderness Act states that wilderness is "protected and managed so as to preserve its natural conditions." In short, wilderness ecological systems are substantially free from the effects of modern civilization. This quality is degraded by intended or unintended effects of people on the ecological systems inside the wilderness area since its designation.

Undeveloped

The Wilderness Act states that wilderness is "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation," ". . .where man himself is a visitor who does not remain" and "with the imprint of man's work substantially unnoticeable." This quality is degraded by the presence of structures, installations, habitations, and by the use of motor vehicles, motorized equipment, or mechanical transport that increases the ability of people to occupy or modify the environment.

Solitude or a Primitive and Unconfined Type of Recreation

The Wilderness Act states that wilderness has "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This quality is about the *opportunity* for people to experience wilderness; it is not directly about visitor experience by itself. This quality is degraded by settings that reduce these opportunities such as visitor encounters, signs of modern civilization, recreation facilities, and management restrictions on visitor behavior.

With input from the public during the early stage of this planning effort, the National Park Service developed the following set of wilderness quality narratives for the park wilderness area.

Other Features and Values

The Wilderness Act states that a wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." This fifth quality, unlike the other four, is unique to Petrified Forest National Park wilderness based on the features that are inside the wilderness (NPS 2012). Paleontological resources and archeological resources clearly fit within this fifth quality of wilderness character because they are tangible features that have scientific, educational, scenic, or historical value. This quality is degraded due to deterioration or loss of archeological resources and paleontological resources.

WILDERNESS CHARACTER NARRATIVES

Untrammeled

The Petrified Forest National Park Wilderness Area has been affected primarily by the forces of nature and is an area where the wilderness is largely untrammeled by man. In this wilderness area, there are few unauthorized actions or federally authorized land management actions that have affected the untrammeled quality by manipulating the biophysical environment. More specifically, the National Park Service takes few actions that might affect plants, animals, pathogens, soil, water, or fire in this wilderness area.

However, there are some current and future threats to this quality of wilderness character. Unauthorized actions that affect this quality include the trespass of livestock and ATVs into the wilderness area and damage or illegal collection of archeological or paleontological resources. Authorized actions that could affect this quality include maintenance of the boundary fence, application of nonnative and invasive species treatments (e.g., tamarisk and Russian thistle), ecosystem restoration, and disturbance due to paleontological and archeological activities.

Additionally, the purpose of Petrified Forest National Park is to preserve, protect, and provide opportunities to experience globally significant Late Triassic paleontological resources, nationally significant archeological sites, and scenic and natural resources, including the Painted Desert, and to foster scientific research and public understanding and appreciation of park resources. The collection and preservation of these resources, while impactful to the untrammeled nature of the wilderness area, are necessary to fulfill the purpose of the park.

Natural

In the Petrified Forest National Park Wilderness Area, the integrity of the ecosystem relies on natural processes for renewal and regeneration. The health of the regionally significant grasslands and presence of rare wildlife species evokes a sense of the primitive West. As such, the wilderness area serves as a bellwether for climate change and a baseline for the study of other similar ecosystems that have been affected by human development and use.

Evolving landforms prevail and reveal the history of geologic time. Sculptured hoodoos, tumbled talus slopes, petrified wood, and paleontological resources are revealed as the landscape continues to change. Windswept landscapes, flash floods, and seasonal watering holes are driving forces within this system. The interaction of the underlying geology with natural processes results in a unique landscape that was and is unsuitable for development. As a result, this preserved and undisturbed wilderness area provides rare opportunities to witness natural processes acting on the landscape. Extraordinary sights, sounds, and smells abound in this natural environment.

Geologic and climatic systems provided the foundation for the ecosystems that developed within the wilderness area. Geologic processes influenced and shaped the ecological diversity that is now characteristic of the wilderness. Pristine shortgrass prairie, badlands, sand dunes, playa lakes, and riparian areas are among the distinct ecological zones that occur across the variable elevations in the region's semi-arid climate.

The natural quality of wilderness character could be degraded due to encroaching development, climate change, introduction of nonnative species, habitat fragmentation, and possible effects of visitor use on the wilderness units. Activities that could affect the natural quality of the wilderness area include social trails (e.g., damage to biological soil crusts), rock cairns, livestock trespass, ATV trespass, littering and vandalism. Natural sounds and night skies are currently threatened by mining and other external forces. This delicate ecosystem does not

recover easily from impacts, and the loss of connectivity with surrounding landscapes is also a threat to keystone species living in or near the two wilderness units (e.g., prairie dogs and pronghorn).

Undeveloped

The pristine, undeveloped lands of Petrified Forest National Park were considered prime candidates for becoming one of the first designated wilderness areas in the national park system. Unlike areas that may require removal of developments in order to become eligible for wilderness designation, the two wilderness units of Petrified Forest were free of any permanent improvements or modern human occupation. Furthermore, the lack of private inholdings made it not only easier to designate wilderness, but also helps to maintain wilderness values to this day. Its remoteness, the lack of water, extreme topography, and harsh conditions have limited land use and development of the area. The only evidence of past use (such as rusted out vehicles and old road traces) speaks to the challenging conditions of the area and the inability of modern humans to establish a permanent foothold.

Since wilderness designation, the management strategy of park staff has been to refrain from adding any developments. Only a few modern signs of humans can be found—for example, geologic survey markers are unobtrusive and minor considering the vastness of the wilderness area. The boundary fence surrounding the wilderness area is another modern development; however, it is essential for wilderness preservation in order to prevent livestock and ATVs from entering the area.

Solitude or Primitive and Unconfined Recreation

The Petrified Forest National Park Wilderness Area evokes a special sense of place for visitors that explore this vast and open landscape. With low visitation and lack of infrastructure, the wilderness area provides opportunities for solitude, and is the epitome of primitive and unconfined types of recreation. With no trails, no signs, no accessible water sources, and no campsites, visitors must come prepared, must be self-reliant, and are personally responsible for their choices and experiences. Nature reigns supreme as natural processes and elements influence visitation due to flooding, high winds, excessive heat, and lack of a potable water source. The park does not provide visitors with suggested travel plans or destinations, which leaves visitors with a sense of freedom to explore.

From grasslands to badlands, the natural ecosystems set the stage for solitude and unconfined recreation opportunities. With each ridge crested and every valley explored, the story of the wilderness unfolds. The meandering topography, undeveloped views, pristine soundscapes, and dark night skies provide visitors with the opportunity to experience solitude, freedom, and spirituality in a setting that is undisturbed by modern human influences. Challenges to the pristine, undeveloped nature of the wilderness area are primarily external and beyond the control of the National Park Service. Surrounding development and industry can contribute to the degradation of dark night skies, natural sounds, and viewsheds as experienced from within the wilderness area. For example, traffic on Interstate 40, cell towers, wind and solar energy development, mining, other similar developments, and the broader implication of climate change can have profound effects on solitude and the primitive quality of the wilderness area. The vastness of the landscape magnifies the impacts of these surrounding developments and is therefore more vulnerable to these threats.

Educating visitors about the wilderness area and encouraging use would provide more people with opportunities to have the wilderness experience. However, increased visitation to the wilderness area has the potential to impact resources and visitor

experience, which could lead to increased evidence of and damage from human activities including crowding; signs of human waste; cairns; and disturbance to artifacts, petroglyphs, and petrified wood. Wind-blown trash, air tours, and the broader implication of climate change can also have profound effects on the experience of visitors. It is important to note conditions are not uniform throughout the north and south wilderness units and some threats are higher in certain sections of the wilderness.

Other Features and Values

The park wilderness area contributes in a significant way to the broader mission of the park to preserve, protect, and provide opportunities to experience globally significant Late Triassic paleontological resources, nationally significant archeological sites, and to foster scientific research and public understanding and appreciation of park resources. Many specific features of exceptional paleontological and archeological value are preserved because of their location in the wilderness. Paleontological resources and cultural sites clearly fit within this fifth quality of wilderness character because they are tangible features that have scientific, educational, scenic, or historical value (NPS 2012).

Paleontological resources (including petrified wood and other fossils) are keys to the past, and scientific research unlocks the history of 15 million years of ecosystem evolution. The park wilderness area includes a substantial portion of the fossil-bearing Chinle Formation, which formed between 205 and 220 million years ago during the Late Triassic period of earth's history. In this unique environment, there is the increased potential for discovering fossilized remains of early dinosaurs, amphibians, insects, fish, and other plants and animals. Today, new fossils surface as the landscape continually evolves with wind, rain, and time (NPS 2010b).

The wilderness area is also rich in human history. Archeological resources within Petrified Forest National Park wilderness include artifacts, dwellings, petroglyphs, and other clues to peoples who inhabited this area for nearly 10,000 years. The Hopi, Zuni, and Navajo tribes of today have centuries of cultural connections with this place, and a variety of beliefs and practices may be represented by the petroglyphs found here (NPS 2011c).

Both archeological and paleontological resources provide clues about the wilderness and its living past. The collection and preservation of these resources, which could affect the untrammeled nature of the wilderness area, are necessary to fulfill the purpose of the park. Unauthorized actions that affect this quality include damage or illegal collection of archeological or paleontological resources.

General Status and Trends of Wilderness Character

General status and trends of wilderness character provide a reference point against which change over time is measured and evaluated. Therefore, it is necessary to discuss the status and trends of the park wilderness area at the beginning of the planning effort in order to better understand what is needed to maintain or improve these conditions. This assessment includes general status, trends, and issues and threats to the five qualities of wilderness character. Desired conditions for each wilderness quality are also described. Desired conditions are the basis for the goals and objectives of this plan, and therefore, are a component of the preferred alternative

Discussion about the general status and trends of wilderness character are simply the beginning point for tracking trends and do not imply that these conditions are "good," "bad," or "desired." For example, at the time of designation, a wilderness may have existing roads, and these roads would be part of the baseline condition of that wilderness.

Monitoring would show how the undeveloped quality of wilderness stays the same if the roads are not removed or improves if these roads are removed. The basic questions of this assessment include:

> ***General Status:*** What characteristics best describe the present state of wilderness quality?
>
> ***Trends:*** What is happening to the characteristics of wilderness quality over time?
>
> ***Issues and Threats:*** What factors may be degrading wilderness quality and what potential factors may threaten wilderness quality in the future?
>
> ***Desired Conditions:*** What conditions of wilderness quality are we seeking to achieve in the future?

Table 2 describes the general status and trends of the five qualities of wilderness character for the Petrified Forest Wilderness Area.

PLANNING ISSUES

An important step in any planning process is the scoping or "discovery" phase, in which initial ideas about what the plan should address are gathered. The planning team began this step by developing a preliminary set of issues facing the park wilderness area, which was largely derived from the general status and trends described above. These issue statements were then presented to the public during the formal scoping period for the plan. Public comments received validated these statements as the central issues that need to be addressed.

Visitor Use. What strategies are appropriate for managing visitor use in the wilderness area to ensure that evidence of human activities (e.g., human waste, social trails, vandalism) does not diminish the wilderness experience for others?

Paleontological and Archeological Research. What strategies are appropriate for conducting scientific research within the wilderness area to ensure wilderness resources and values are protected?

Boundary Fence. What is the most appropriate way to maintain the boundary fence around the park wilderness area in a manner that is consistent with wilderness management requirements?

External Developments. How can the National Park Service protect the quality of wilderness in the face of increasing developments surrounding the park (e.g., potash mining, wind and solar energy development, communication towers, etc.)?

Community Outreach. How can the National Park Service engage its neighbors to encourage thoughtful development that will reduce impacts to wilderness character?

TABLE 2. GENERAL STATUS AND TRENDS OF WILDERNESS CHARACTER

Untrammeled			
General Status	**Trend**	**Issues and Threats**	**Desired Condition**
Broad Level: The wilderness area is relatively unhindered and free from human control or manipulation.	**Stable**, There are few authorized or unauthorized actions occurring that impact biophysical resources.	Authorized actions that could affect this quality include eradication of nonnative species (e.g., tamarisk and Russian thistle), maintenance of the boundary fence, and scientific research. Unauthorized actions that could affect this quality include livestock and ATV trespass and damage to or illegal collection of archeological and paleontological resources.	Authorized actions that do not adversely affect natural features and processes in the wilderness area.
Specific: Eradication of nonnative species in the wilderness area.	**Stable.** The removal of nonnative species does occur on a regular basis, but this action should diminish over time as nonnative species are eradicated from the wilderness area.	Management actions needed to eradicate nonnative species may leave lasting evidence of treatments.	A healthy native grassland community free from nonnative species and the manipulation of the environment to eradicate them.
Specific: The boundary fence is routinely maintained along the wilderness area in order to protect wilderness character. Maintenance is conducted using vehicles along a two-track road just within the wilderness boundary.	**Stable.** The National Park Service continues to maintain the boundary fence on a regular basis. Annual condition assessments are used to determine maintenance needs.	The boundary fence is necessary to prevent livestock and ATVs from entering the wilderness area. The slight degradation of undeveloped character due to maintaining the boundary fence is outweighed by the advantages in protecting wilderness values. Maintenance options are addressed to ensure they meet the minimal tool requirements.	The boundary fence would continue to be maintained in a manner that is least impactful to wilderness character. If lands within the park's expanded boundary are acquired along the wilderness area, then that portion of the boundary fence would be considered for removal.

TABLE 2. GENERAL STATUS AND TRENDS OF WILDERNESS CHARACTER

Untrammeled			
General Status	**Trend**	**Issues and Threats**	**Desired Condition**
Specific: Scientific research is ongoing. Approximately 20 educational institution-sponsored research projects are conducted each year within the park and a portion of those occur within the wilderness area.	**Stable.** The National Park Service continues to partner with educational institutions to foster paleontological and archeological research within the park.	Research activities have the potential to trammel the wilderness area. Most fossils are brought out on foot, but occasionally a wheeled conveyance is used to carry out larger items. The introduction of modern sounds and technology associated with excavation can further diminish this quality.	Perform scientific research using minimum requirements to ensure preservation of wilderness character.
Specific: Unauthorized actions include the occasional trespass of livestock and ATVs and damage to or illegal collection of archeological or paleontological resources.	**Stable.** These unauthorized actions occur only periodically on a limited basis.	Trespass livestock and ATVs may introduce nonnative species, trample vegetation and other sensitive resources, and cause erosion. Damage to or illegal collection of fossils and artifacts can result in the irretrievable loss of nationally and globally significant resources.	A wilderness area free from unauthorized actions that manipulate the natural and cultural environment.

TABLE 2. GENERAL STATUS AND TRENDS OF WILDERNESS CHARACTER

Natural			
General Status	**Trend**	**Issues and Threats**	**Desired Condition**
Broad Level: The ecological systems of the wilderness are generally free from the effects of modern civilization, yet numerous threats exist.	**Degrading.** Although the natural quality of the wilderness area is generally stable, the overall tendency is toward degradation due to the effects of external developments.	The primary threat to the dark night skies, natural soundscapes, and wildlife of the wilderness area is the ongoing encroachment of external developments. The more development occurs near the wilderness area, the greater the effects from light and noise pollution and habitat fragmentation will be on these and other aspects of the natural quality.	The natural quality of the wilderness area substantially free from the effects of modern civilization.
Specific: Grasslands have largely recovered from historic overgrazing; however, several factors continue to constrain the health of this native ecosystem.	**Stable.** Historic livestock grazing no longer occurs.	Nonnative plant species, trespass livestock intrusions, fire suppression, and long-term droughts have the potential to degrade the grassland ecosystem.	Healthy grasslands exist free of nonnative species. No restriction to native plant dispersal will occur.
Specific: Pronghorn habitat in the wilderness is generally in good condition, but habitat connectivity is limited.	**Possibly Degrading.** There is little information about the historic size and distribution of the pronghorn population in the wilderness area, but ongoing habitat fragmentation in the region may be affecting herd connectivity.	Pronghorn herd connectivity between the wilderness and surrounding area is affected by a number of barriers—primarily the interstate highway, railroad, and fences.	Large mammals, including pronghorn, migrate freely in and out of the wilderness area with suitable passage across human-made barriers.
Specific: Prairie dog colonies within the park are in decline and few exist within the wilderness area.	**Degrading.** Prairie dog populations in the park have been decreasing over time, possibly due to the plague and habitat changes.	Prairie dogs do not appear to be re-establishing colonies in the park or wilderness area. The cause of this is unknown.	Healthy prairie dog populations that thrive within the wilderness area.
Specific: Nonnative plant species (e.g., tamarisk, tumbleweeds, cheatgrass, and other invasive plants) are present in the wilderness area.	**Stable.** Nonnative species are present and well-established in areas, but treatments are controlling their spread.	Without the continual treatment of nonnative species, their spread would likely continue, especially along washes where seeds are easily transported via flash floods during storm events.	Native species thrive in wilderness areas free from the effects of nonnative species.

TABLE 2. GENERAL STATUS AND TRENDS OF WILDERNESS CHARACTER

Natural			
General Status	**Trend**	**Issues and Threats**	**Desired Condition**
Specific: The dark night sky of the wilderness area is exceptional; however, it is threatened by a variety of external developments that contribute to light pollution.	**Degrading.** Due to existing external developments and the likelihood of additional developments in the vicinity of the wilderness area.	Existing external developments that contribute to light pollution near the wilderness area include communication towers, the interstate highway, and an algae processing plant. Potential new developments that could impact wilderness area night skies include a casino, potash exploration and mining, and wind and solar energy developments.	The dark night skies of the wilderness area are unimpaired by external developments.
Specific: Air quality of the wilderness area is in excellent condition with up to 160 miles of visibility on clear days; however, air quality is threatened by potential external developments.	**Stable.** The current level of external developments that emit air pollutants have a minimal effect on the air quality of the wilderness area.	Developments that could impact wilderness area air quality include a coal-fired power plant and potash mining. Climate change may also influence air quality due to added particulates resulting from a warmer and drier climate.	The air quality of the wilderness area is maintained in an excellent condition.
Specific: The natural soundscape of the wilderness area is in good condition with only infrequent human-made noise intrusions. However, there are a variety of external threats to the soundscape.	**Stable.** Recent studies show that natural sounds are predominate with few external intrusions.	Threats to the natural soundscape of the wilderness area include increased railroad use, highway traffic, air tours, over-flights, encroaching development (mining), and the potential for increased wilderness use by visitors.	Natural sounds dominate in the wilderness area free from human-made noise intrusions.
Specific: Water quality is in good condition; however, there is limited amounts of water available in the wilderness area—primarily found intermittently in washes.	**Possibly Stable.** Water quality is not degrading and the washes have not been modified with diversions. However, climate change and groundwater usage in the region may be altering the water regime (e.g., some natural springs and seeps are drying up).	Threats to water resources of the wilderness area include external developments and industry that withdraw groundwater, nonnative plants along washes that alter water regimes, and climate change.	The water resources of the wilderness units remain in good condition, with only natural variability in quality and quantity.

TABLE 2. GENERAL STATUS AND TRENDS OF WILDERNESS CHARACTER

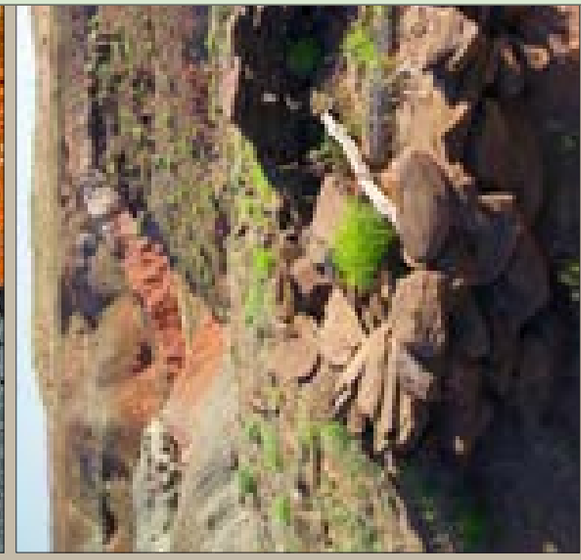
Undeveloped			
General Status	**Trend**	**Issues and Threats**	**Desired Condition**
Broad Level: The wilderness area is essentially undeveloped with no permanent structures, trails, or signs. However, visual intrusions from external developments adversely affect this quality of wilderness character.	**Degrading.** Although the undeveloped quality of the wilderness area is generally stable, the overall trend is degrading due to the effects of external developments.	External developments are the primary threat to the undeveloped character of the wilderness. Cell towers, railways, the interstate highway, mining, wind and solar energy developments all have the potential to degrade this wilderness quality because of visual intrusions and light, noise, and air pollution.	The National Park Service would work with adjacent landowners to reduce impacts on the undeveloped character of wilderness (minimal lighting, etc.). Partnerships would seek to stabilize (or improve) the trend. Desired conditions include dark night skies, clean air, natural sounds, healthy plant and animal communities, and unobstructed views.
Specific: Currently, there is only one public access point into the north wilderness unit (via Kachina Point); otherwise, the wilderness area is essentially free from any visitor-related developments.	**Stable.** Even with only one access point into the north wilderness unit, no trails or signs actually exist within the wilderness itself, nor are any proposed.	The main public access point into the north wilderness area has a tendency to concentrate visitor use and affect solitude, but this approach maintains the lowest level of development possible.	The undeveloped quality of the wilderness area remains essentially free of any permanent developments. Any additional access points into the north wilderness unit to disperse use and enhance solitude would occur without degrading this quality of wilderness character.
Specific: There are some signs of historic use in the north wilderness unit such as a few rusted-out vehicles and road traces.	**Improving.** Evidence of historic use continues to slowly weather away and over time will eventually disappear.	Evidence of historic use only slightly degrades the undeveloped character of the wilderness because these are not modern signs of human use and it is only slightly evident to visitors.	Continue to allow signs of historic use to weather away, rather than remove them, since removal would be highly impactful to overall wilderness character.
Specific: Survey markers to mark archeological and paleontological research sites are considered unobtrusive, but they do influence the undeveloped character of the wilderness.	**Stable.** Survey markers continue to be used on a case-by-case basis for research purposes.	Survey markers only slightly degrade the undeveloped character of the wilderness because they are unobtrusive.	Consider other techniques to mark the location of research sites when possible (e.g., GPS and photo points) in order to minimize the use of survey markers.

TABLE 2. GENERAL STATUS AND TRENDS OF WILDERNESS CHARACTER

Solitude or Primitive and Unconfined Recreation			
General Status	**Trend**	**Issues and Threats**	**Desired Condition**
Broad Level: The wilderness area is considered to be the epitome of solitude or primitive and unconfined recreation due to the lack of infrastructure, low visitation, and vast rugged landscape.	**Stable.** Management of the wilderness units seeks to maintain this quality of wilderness character; however, external developments have the potential to degrade this quality.	External developments (e.g., cell towers, railways, the interstate highway, mining, and wind and solar energy developments) detract from the sense of solitude and isolation that visitors seek in wilderness areas.	The National Park Service would work with adjacent landowners to reduce impacts on external developments on the wilderness recreation experience. Partnerships would seek to stabilize (or improve) the trend. Desired conditions include dark night skies, clean air, natural sounds, healthy plant and animal communities, and unobstructed views of the horizon.
Specific: The wilderness area is largely free from evidence of human use; however, there is a possibility of encountering other visitors and observing signs from other visitors (e.g., footprints and rock cairns).	**Possibly Stable.** More information is needed about encounter rates, evidence of use, and day-use visitation in the wilderness. Anecdotally, these do not appear to be increasing, but additional monitoring is needed.	Potential threats to this wilderness quality include noise disturbances, high encounter rates, crowding, footprints, social trail formation, improper waste disposal, rock cairns, wind breaks, and vandalism (i.e., removal or defacement of cultural and natural artifacts and objects).	Staff and visitors would be educated in appropriate wilderness use in order to minimize human impacts and signs of human use.
Specific: The wilderness area provides great opportunity for self-reliant recreation, discovery, and unconfined exploration.	**Stable.** Limited restrictions on visitor movement throughout the wilderness area and the lack of infrastructure (e.g., no trails, signs, or designated campsites) helps to ensure this wilderness quality remains stable over time.	Visitor safety and understanding of the wilderness is an issue. Generally, park visitors are not aware of the opportunity to experience self-reliant recreation in the wilderness area.	Provide more wilderness and safety information to park visitors (i.e., more messaging at the trailhead that lead to the north wilderness unit and possibly on the park website and in the visitor center).

TABLE 2. GENERAL STATUS AND TRENDS OF WILDERNESS CHARACTER

Other Features and Values			
General Status	**Trend**	**Issues and Threats**	**Desired Condition**
Broad Level: The wilderness area is unique because it contains tangible features of scientific, educational, scenic, and historical value, which make up this fifth quality of wilderness. Specifically, the wilderness character is rich in both paleontological and archeological resources.	**Possibly Stable.** The trend is possibly stable yet difficult to determine for paleontological resources since a full inventory has not occurred, and because natural processes expose these resources sporadically. The trend for archeological resources is possibly stable, although much of the northern unit has not been investigated.	Issue and threats to paleontological and archeological resources included natural weathering processes, trespass cattle, vehicles, and possible damage from visitor use.	Scientifically significant fossil resources will be protected and preserved, and collected when necessary for preservation. Archeological resources will be protected in situ when possible.
Specific: Paleontological resources occurring in the wilderness area (especially exposed fossils) may be lost due to natural erosional processes. Exposed petrified wood is less affected by natural weathering processes.	**Possibly Stable.** A trend is difficult to determine since a full paleontological inventory of the wilderness area has not occurred.	Without a comprehensive inventory and continual monitoring, it is difficult to assess the rate at which exposed fossils are lost due to natural erosional processes. Once fossils are exposed on the surface, they rapidly deteriorate and undiscovered Late Triassic species could be lost forever. Illegal collection and vandalism is also a threat, although likely minimal due to access limitations.	All scientifically significant fossil resources are collected and preserved before they are lost due to exposure or illegal collecting.
Specific: Archeological resources in the wilderness area are generally in stable condition and retain integrity contributing to their national register eligibility. Some sites may be at potential risk of disturbance by natural processes and visitor use.	**Possibly Stable.** Recent archeological surveys have expanded the acreage surveyed in both the north and south wilderness areas, although much of the northern unit has not been fully investigated.	Potential threats to archeological resources may be attributed to natural processes and visitor use (e.g., social trails, illegal collection of artifacts, off-road vehicles) that can erode, deflate, or damage the stratigraphy of sites and their informational content.	Archeological resources are protected in situ to the greatest extent possible unless site disturbance or other threats necessitate that data recovery excavations are undertaken to recover important information before it is irretrievably lost. Significant sites are ideally monitored on a regular basis to assess conditions, and protective measures are undertaken as necessary.



INTRODUCTION

OVERVIEW

The purpose of this Wilderness Stewardship Plan is to guide preservation, management, and use of the park wilderness area to ensure it remains unimpaired for future use and enjoyment. Because there are different approaches to managing wilderness, the planning team investigated different management alternatives. The National Environmental Policy Act and NPS policies require that park managers consider a full range of reasonable alternatives, including a no-action alternative and an environmentally preferable alternative, before choosing the preferred alternative. The alternatives must (1) be consistent with the Wilderness Act and park enabling legislation, (2) reflect a full range of stakeholder interests, (3) provide for a variety of visitor experiences, and (4) fully consider the potential for environmental impacts. The alternatives must also be consistent with the park's general management plans, while expanding upon guidance related to wilderness protection.

This chapter describes how these alternatives were developed and identifies the alternative preferred by the National Park Service, and includes the following management components, which have been incorporated as part of the alternatives:

- goals and objectives
- management zoning
- natural and cultural resource management strategies
- visitor use and experience
- management strategies
- park operations
- partnership strategies
- management strategies to address climate change
- monitoring framework / user capacity
- programmatic minimum requirements
- mitigative measures

The alternatives also include desired conditions, which are the building blocks of the goals and objectives. Please refer to table 2 in chapter 1 for the desired conditions as they relate to the five qualities of wilderness character.

The environmentally preferable alternative and alternatives considered but dismissed are also described, along with staffing and cost estimates. The impacts of each alternative are summarized in table 3 (at the end of this chapter) from the information presented in "Chapter 4: Environmental Consequences"—pursuant to the National Environmental Policy Act.

GOALS AND OBJECTIVES

Goals and objectives are the basis of a wilderness stewardship plan as they establish the overall direction for the park wilderness management program. Broad-level goals have been developed for the five qualities of wilderness character. They provide a connection between the wilderness character narratives and desired conditions described in chapter 1 and the alternative management strategies that are designed to ensure the desired conditions are achieved. Objectives have been developed for each wilderness quality. Goals can be differentiated from objectives as they are usually broader and farther reaching, while objectives are more specific, with measurable outcomes.

The following goals and objectives identify what the plan needs to address for long-term successful management and protection of the wilderness.

Goal 1: Untrammeled

Protect the untrammeled quality of wilderness character from degradation due to actions of human control or manipulation.

Objectives:

- Minimize authorized and unauthorized actions that negatively affect native plants, animals, pathogens, soil, water, or fire in the wilderness area.
- Increase visitor and staff awareness of the untrammeled qualities of wilderness via education and outreach.

Goal 2: Natural

Protect and restore ecological systems in wilderness to ensure that they are substantially free from the effects of modern civilization.

Objectives:

- Improve the natural quality of wilderness character by:
  - reducing presence of invasive species
  - promoting native species
  - protecting natural soundscapes, dark night skies, air quality, and viewsheds
  - reducing barriers to animal migration
  - increasing visitor awareness of the natural qualities of wilderness via education and outreach
  - allowing natural processes to occur unhindered

Goal 3: Undeveloped

Ensure that the wilderness area retains its primeval character and influence; essentially without improvement or human occupation.

Objectives:

- Protect the undeveloped quality of wilderness character by:
  - working with adjacent landowners to minimize external threats and to reduce impacts on the undeveloped quality
  - determining appropriate access into the wilderness to protect solitude without degrading the undeveloped quality
  - reducing the use of permanent marking (i.e., monumenting, survey markers for paleontological sites, archeology, and other disciplines, long-term inventory and monitoring)
  - increasing visitor awareness of the undeveloped quality of wilderness via education and outreach
  - minimizing the use of trails and signs (trails, virtual trails, signs, waste management containers, campsites, permits)

Goal 4: Solitude or Primitive and Unconfined Recreation

Provide outstanding opportunities for solitude or primitive and unconfined types of recreation.

Objectives:

- Promote and create opportunities for solitude or primitive and unconfined types of recreation while protecting the integrity of the overall wilderness character. This could be achieved by:
  - creating a monitoring plan to understand visitor use trends in wilderness, and to document

inappropriate evidence of human use
  - increasing visitor awareness of how to enjoy and use wilderness properly via education and outreach

Goals 5: Other Features and Values

Protect wilderness features that have scientific, educational, scenic, or historical value.
Objectives:

- Protect other features and values essential to wilderness including those with scientific, educational, scenic, or historical value. This could be achieved by:
  - Increasing visitor and staff awareness of the paleontological and archeological resources in wilderness units via education and outreach
  - preventing theft of petrified wood
  - protecting and preserving significant threatened fossil resources
  - preventing theft of archeological resources
  - protecting and preserving significant archeological and historical resources

HOW THE ALTERNATIVES WERE DEVELOPED

The planning team developed a set of preliminary alternatives during a three-day workshop held at Petrified Forest National Park in August 2011. Input received during public scoping was fundamental to developing the alternatives; public comments were referred to extensively throughout the workshop. A summary of public comments received can be found in the appendixes of this plan. Scoping comments were also used to develop the planning issue and opportunity statements presented in chapter 1. An important aspect of the alternatives is to address these issues within the context of the Wilderness Act.

After the workshop, the alternatives were further developed and refined through a series of meetings and conference calls. The final set of alternatives presented in this chapter represent a broad range of ideas designed to best achieve the purpose of the plan—to guide preservation, management, and use of the park wilderness area to ensure it remains unimpaired for future use and enjoyment.

The development of alternatives began with generating a list of different management concepts that describe the overall character of the wilderness area, emphasizing particular resource conditions and associated visitor experiences. After developing this list, it was determined that there was little variation due to the high level of protection afforded under the Wilderness Act. The three primary differences include public access points, backcountry camping, boundary fence maintenance, and scientific research.

Because of the limited number of designated public access points in the north and south wilderness units, the planning team explored a number of potential new access options. The team also explored the option of allowing dispersed backcountry camping along the southern boundary of the north wilderness.

Furthermore, the planning team explored alternative ways to maintain the boundary fence and conduct scientific research in the wilderness area.

As a result of few viable options available for developing a range of over-arching management concepts, the team determined that it was best to develop two alternatives for the plan—the no-action alternative, which represents continuation of current management, and one action alternative, which has been identified as the NPS preferred alternative.

IDENTIFICATION OF THE NPS PREFERRED ALTERNATIVE

Alternative B has been identified by the National Park Service as the NPS preferred alternative. It was identified by comparing the relative advantages of each alternative, and it was found to provide a more proactive, comprehensive approach to protect wilderness character than the no-action alternative. This is demonstrated by a number of key attributes of alternative B:

- better delineation of access to the north wilderness
- increased awareness and education to both visitors and park staff
- improved management of the backcountry area that provides an interface for visitors between the north wilderness unit and the frontcountry area of the park
- a programmatic approach to paleontological and archeological research and boundary fence maintenance
- looking beyond the boundaries of the park to partner with neighbors and communities to address the effects of expanding adjacent developments on wilderness resources and values

Overall, alternative B provides the best combination of management strategies for protecting the five qualities of wilderness character—a balance that ensures resource preservation and appropriate visitor use for the long-term future. This practical, common-sense approach to wilderness management does not contain extreme proposals that would generate controversy; rather, a practical approach was widely supported in public comments received during scoping for this planning effort.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

During the planning process, other management approaches were considered, including expanded access to the north and south wilderness units and various options for conducting scientific research and boundary fence maintenance. However, these alternatives were dismissed due to the inability to meet project objectives and because these approaches conflict with an up-to-date and valid park plan. It was also determined that little variation in wilderness management is possible due to the high level of protection afforded under the Wilderness Act, which limits the range of viable alternatives.

Because of the limited number of designated public access points in the north and south wilderness units, the planning team explored a number of potential new access options. Four new access points were considered for the north wilderness unit, but two were dismissed because of the infeasibility of providing public access routes across backcountry park lands. This is primarily because of motorized vehicle restrictions within the preservation emphasis zone, as described in the park 2004 General Management Plan. This zone restricts visitors from driving on existing two-track roads across the backcountry to the wilderness boundary. For the south wilderness unit, it was determined that designated access points could increase visitation, resulting in potential adverse impacts to wilderness character and fragile archeological resources. (Park staff would continue to assist visitors requesting information about access into the south wilderness unit, but they would not promote such access.)

The planning team explored alternative ways to maintain the boundary fence and conduct scientific research in the wilderness units. However, this has been addressed through completion of the Minimum Requirements Decision Guides (MRDGs). Since the MRDGs include analyzing a range of management options in order to select the best way to protect wilderness qualities, it was decided

that this approach would yield the most appropriate management strategies to carry forward. These MRDGs are included in appendix D. Furthermore, there was a lack of divergent public opinions received during scoping about how the wilderness should be managed. A wider range of opinions could have led to other alternatives being considered, but this was not the case.

THE ALTERNATIVES

ALTERNATIVE MANAGEMENT CONCEPTS

Two alternative management concepts were developed for the planning effort. Alternative A, also referred to as the no-action alternative, represents continuation of current park management. Alternative B emphasizes a more proactive, comprehensive approach to wilderness management—it has been identified as the NPS preferred alternative. The following describes the management concepts for each of these alternatives.

Alternative A Concept (No Action)

Under the no-action alternative, the National Park Service would respond to future needs and conditions associated with wilderness management without major changes in current actions, programs, and plans. Natural resources, cultural resources, visitor use and experience, operations, and partnerships would continue without a comprehensive approach to wilderness management. Wilderness management would continue to be conducted in compliance with various federal and state laws, NPS *Management Policies 2006*, and the existing general management plans (1993, revised 2004, amended 2010) and backcountry management plan (1979).

Alternative B Concept (NPS Preferred Alternative)

Under alternative B, the National Park Service would adopt a proactive, comprehensive approach to wilderness management. This approach would include a variety of strategies designed to achieve the goals and objectives set forth in this plan—to protect and enhance wilderness character in both the north and south wilderness units of the park. This alternative looks beyond the boundaries of the wilderness units to address backcountry management issues. These backcountry areas provide an important interface for visitors traveling from the frontcountry of the park into the north wilderness unit. Effective backcountry management has a direct effect on the protection of wilderness qualities and visitor enjoyment of these rugged and remote regions of the park where a greater degree of wilderness experience; self-reliance is required.

MANAGEMENT ZONING (COMMON TO BOTH ALTERNATIVES)

Management zoning is the method used by the National Park Service to identify and describe the appropriate variety of resource conditions and visitor experiences to be achieved and maintained in different areas of a park. Management zones are developed and allocated in a manner that is compatible with park purpose, significance, and fundamental resources and values.

Petrified Forest National Park has an approved set of management zones that were developed as part of the General Management Plan Revision (2004). As described in this overarching management plan, both wilderness units in the park are within the preservation emphasis zone (see map). Per the direction set forth in the general management plan, the Wilderness Stewardship Plan would adopt the desired resource conditions and visitor experiences of the preservation emphasis zone, as summarized below:

Resource Condition

Natural and cultural resources are unimpaired and generally unaffected by human influences. Natural processes prevail. Evidence of recreational use is not readily apparent.

Natural landscapes and soundscapes predominate. This zone may occur in wilderness or nonwilderness areas. Resource inventory and monitoring activities help to identify and protect resources.

Visitor Experience and Appreciation

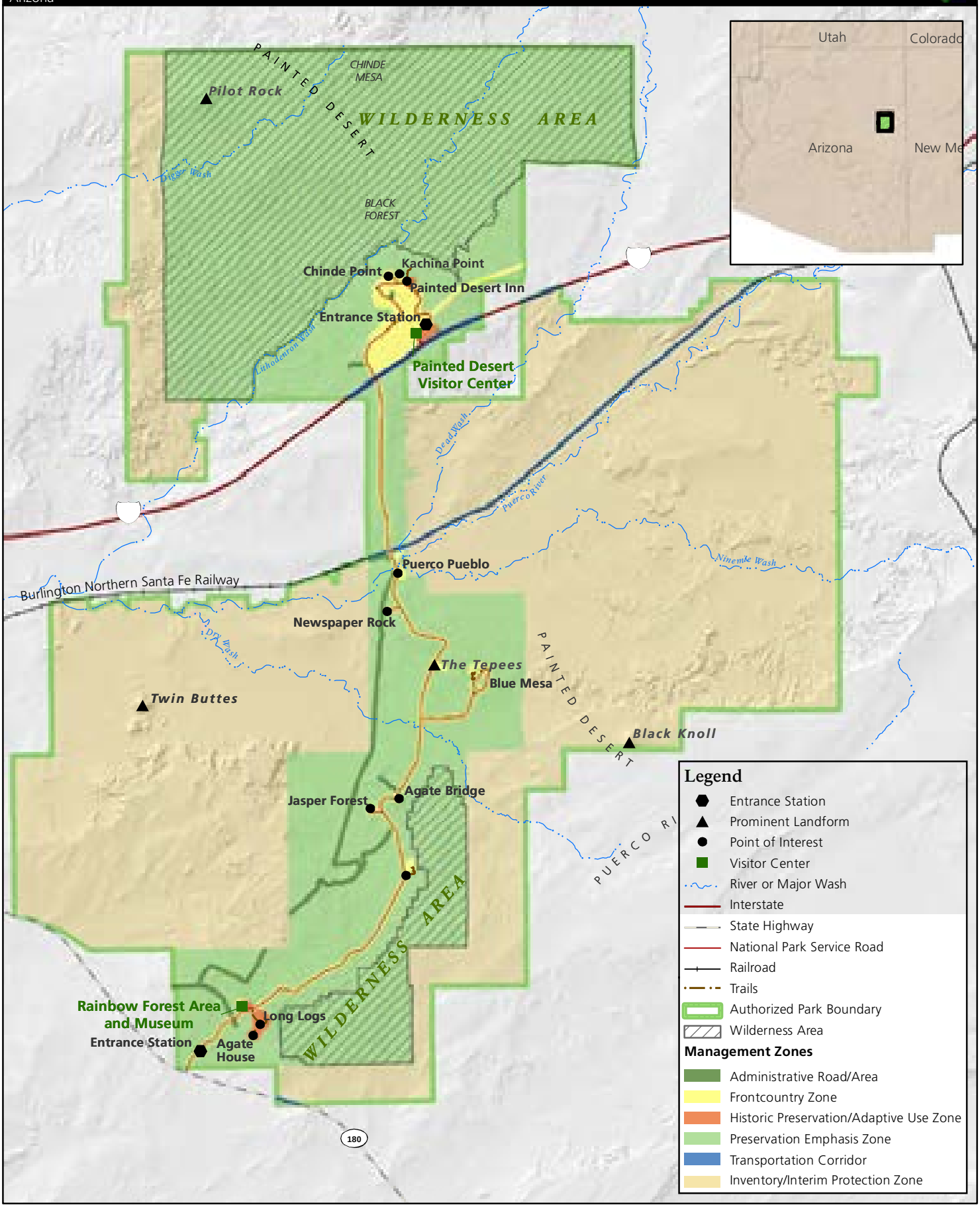
Visitors explore remote areas of the park in a natural setting. Opportunities for solitude, independence, closeness to nature, and adventure are key experiences. Chance encounters with other visitors or park staff are relatively few. Self-reliance is emphasized, as these areas are without comforts or conveniences. Visitors require outdoor skills and must be self-sufficient. Limits on numbers of visitors, length of stay, and overnight use may be in place. A visitor permit system may be implemented if it is needed to protect resources.

Facilities and Activities

Common visitor activities include cross-country hiking, backpack camping, horseback riding, enjoying nature, wildlife viewing, and photography. Visitor access is by foot or horseback (bicycling is not permitted). Overnight use may be limited to certain areas. Buried utilities, primitive and unmaintained trails, and road traces may be present, but the latter are not designated routes. Management activities include research and monitoring, occasional administrative use of primitive roads, and stabilization and restoration of natural and cultural resources. In designated wilderness, management is consistent with NPS wilderness management policies.

Management Zones
Petrified Forest National Park
Arizona

National Park Service
U.S. Department of the Interior



Produced by: NPS Denver Service Center Planning Division
December 2011

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ALTERNATIVE MANAGEMENT STRATEGIES

Each alternative includes broad-based management strategies that would be applied across the wilderness area, as well as a portion of backcountry that provides an interface between the north wilderness unit and the frontcountry of the park. These strategies are organized by natural and cultural resources, visitor use and experience, park operations, and partnerships and outreach. These strategies vary by the no-action alternative (1) and the NPS preferred alternative (2). The NPS preferred alternative also includes guiding management principles to address climate change and programmatic minimum requirements to address research activities and boundary fence maintenance within the wilderness area.

ALTERNATIVE A: MANAGEMENT STRATEGIES (NO ACTION)

Natural and Cultural Resource Management

Under the no-action alternative, natural and cultural resource management efforts would continue to focus on protection, inventorying and monitoring, and the restoration of noticeably disturbed areas. Ongoing natural resource management activities include preservation and collection of paleontological resources, and removal of nonnative species (e.g., tamarisk and trespass livestock). Prairie dogs and pronghorn are species of special concern, and habitat restoration efforts would continue to include control of nonnative species. A vegetation management plan and an updated fire management plan will be developed in the near future for the park. Air quality, water quality, natural sounds, and night skies would continue to be monitored with guidance or assistance from national programs. Archeological and other cultural resources would continue to be identified, monitored, investigated, and protected in accordance with all applicable laws and policies.

Wildlife management:

- Limited wildlife management would continue to occur, which includes the use of standard protocols for inventorying and monitoring in wilderness. Protocols would be modified on a case-by-case basis as needed to protect wilderness values.

Vegetation management:

- Baseline vegetation surveys have been completed.
- Continue to inventory and monitor nonnative species.

Paleontological resources (including scientific research):

- Continue to prospect, collect, and curate paleontological objects from wilderness units in partnership with other institutions.
- Continue to inventory, monitor, and document the conditions of paleontological sites.

Special status species:

- Continue to inventory and monitor for the presence of special status species.

Fire management:

- Mimic natural fire regimes to the greatest extent possible in the grasslands to help control the spread of nonnative species.

- The National Park Service is in the process of completing a fire management plan for the park, which includes the designated wilderness area. The plan states that fire management activities would be designed to protect wilderness values.

Air and water quality:

- Continue collecting data on air quality. Water quality data is not collected due to its scarcity.

Soundscapes and night skies:

- Continue collecting data on soundscapes and night skies.

Cultural resources:

- Parkwide monitoring and inventorying requirements of cultural resources exist; however, these are not specific to wilderness.
- Continue to survey archeological and historical resources. Prehistoric sites have been recorded in both wilderness units, and a larger portion of the south wilderness has been surveyed for archeological resources.
- Continue to provide federally recognized tribes with appropriate access to sacred sites and ethnographic resources in wilderness units.

Visitor Use and Experience

Under the no-action alternative, visitors would continue to have a variety of opportunities to experience solitude and primitive or unconfined types of recreation. With no trails, no signs, no accessible potable water sources, and no campsites, the wilderness units would continue to be managed with a focus on self-reliant recreation activities. Access points into the wilderness would remain unchanged, with no improvements, infrastructure, or developments. One formal access point into each wilderness unit would remain, and the majority of visitors would continue to be directed to use the north wilderness unit. Interpretation and educational efforts about wilderness areas would remain unchanged, leaving some visitors with uncertainty about wilderness opportunities, boundaries, and regulations.

Opportunities for solitude and primitive/unconfined recreation:

- Continue policy of no trails and signs, and use camping zones to encourage dispersed use throughout the wilderness area.

Access:

- Continue to allow undesignated, cross-country travel across the backcountry for visitors to access the wilderness.

Camping:

- Continue to allow dispersed camping only in designated wilderness.

Interpretation and education:

- A trailhead wayside would continue to be provided at Kachina Point for visitors accessing the north wilderness unit.
- Wilderness information would continue to be provided to visitors requesting overnight permits.
- A wilderness page would continue to be provided on the park website and in the park newspaper.

Wilderness regulations:

- Permits would continue to be required for overnight camping. Limitations on

total number of nights in one place would continue to be 14 nights.

- Group size limitation for overnight camping would continue to be eight people.
- Stock party size would continue to be limited to a maximum of six animals. A maximum of 12 horses per day would be permitted in the north unit and 6 horses per day in the south unit of the wilderness area. Horse use also would continue to be limited to day use only.
- Pets (dogs only) would continue to be allowed.
- Open campfires would continue to be prohibited.
- The wilderness units would continue to be divided into four camping zones.
- 50 total campers per night at the north wilderness unit and 25 per night at the south wilderness unit would continue to be enforced.
- Camping within the park would continue to be restricted to wilderness only.

Park Operations

Under the no-action alternative, park operations would also continue without substantial changes. Facilities and services would continue to be offered outside the wilderness boundaries. Emergency response and search and rescue activities would continue to include infrequent transport of injured people out of the wilderness, and other necessary emergency operation. Operations within the wilderness boundaries would continue to include the repair and construction of the boundary fence and scientific activities.

Emergency response:

- Continue emergency response on horseback or by foot to carry injured visitors out of the wilderness area. Emergency response would be consistent with the emergency response plan of the park.

Boundary fence:

- Continue to repair and maintain the wilderness boundary fence.

Scientific research:

- Continue to authorize and coordinate research activities in wilderness units on a case-by-case basis and in accordance with the minimum requirements provisions for wilderness management.

Sanitation / waste management:

- No education would be provided.

Partnerships/Outreach

Under the no-action alternative, partnerships and public outreach efforts about the value of park wilderness units would continue to be minimal.

ALTERNATIVE B: MANAGEMENT STRATEGIES (NPS PREFERRED ALTERNATIVE)

Natural and Cultural Resource Management

Natural and cultural resource management efforts would emphasize education of staff, partners, and researchers on wilderness etiquette when conducting preservation, restoration, research, and inventorying and monitoring efforts. Activities would also include the study and collection of paleontological resources in a manner that reduces the overall research footprint in the wilderness. Archeological and other cultural resources would be inventoried, monitored,

investigated, and protected in accordance with all applicable laws and policies. Mitigation would occur on a case-by-case basis for threatened cultural and paleontological sites (i.e., sites threatened by fire or rapid erosion). Optional access points into the wilderness units would be considered for research and monitoring to prevent the establishment of well-defined administrative trails in the wilderness (i.e., ease of access, efficiency in work, minimize impacts on wilderness qualities such as solitude, trammeling, etc.). Nonnative species and refuse would be mitigated in the wilderness through proactive monitoring by park staff, partners, and citizens.

Wildlife management:

- Survey fauna within wilderness to determine habitat use and distribution (may be applied to climate change studies).

Vegetation management:

- Survey flora within wilderness to determine habitat use and distribution (may be applied to climate change studies).
- Develop vegetation management plan for park, including wilderness.
- Inventory for nonnative species in wilderness.
- Work with neighboring properties to manage invasive plants (tamarisk).

Paleontological resources (including scientific research):

- Establish protocols for paleontological research and monitoring within wilderness, also with partners.
- Inventory and monitor and document conditions of paleontological sites in wilderness. Consider using volunteers and education groups to assist.
- Adhere to a programmatic minimum requirements decision guide for conducting research within wilderness.

Special status species:

- Inventory and monitor for the presence of special status species.

Fire management:

- Restore a natural fire regime in the grasslands to control the spread of nonnative species in this ecosystem.
- A fire management plan would be developed for the park, including the wilderness units.

Air and water quality:

- Collect data on air quality.
- Water quality data would not be collected due to scarcity.
- Educate staff and visitors about park air quality and trends and class I air quality requirements.

Soundscapes and night skies:

- Collect data on soundscapes and night skies.
- Educate staff and visitors about traveling quietly and minimizing the use of artificial portable lighting in the wilderness.
- Showcase the dark night skies of the wilderness area to educate partners about the beneficial effects of reducing light pollution. Become a better example through stewardship.

Cultural resources:

- Determine appropriate guidelines for monitoring and managing cultural resources in wilderness.

- Enhance sharing cultural resource information with wilderness visitors (e.g., discovery of remnant bottles, etc.).
- As necessary, archeological and other cultural resources would be inventoried, monitored, and investigated to further resource protection objectives.
- Continue to survey and document the north and south wilderness for archeological and historic sites.
- Perform condition assessments and testing to determine if sites are eligible for the National Register of Historic Places.
- Perform stabilization and mitigation of archeological and other cultural resources that are threatened by natural processes or visitors.
- Continue to provide federally recognized tribes appropriate access to sacred sites and ethnographic resources in wilderness units.
- Adhere to a programmatic minimum requirements decision guide for conducting research within wilderness units.
- Include information received during tribal consultations to assist cultural resource management.

Visitor Use and Experience

Visitors would have a variety of opportunities to experience solitude and primitive or unconfined types of recreation. Because there are no trails, potable water, campsites, etc., education regarding how to be self-reliant would be improved. Visitors would be provided better wilderness orientation and best practices philosophies for low-impact wilderness use. Visitors would be better prepared with an understanding of unique natural and cultural resources that may be experienced, location of wilderness boundaries, and regulations. The existing public access route from Kachina Point into the north wilderness unit would be formalized and better delineated to reduce impacts from visitors and park staff. Additional public access points into the north wilderness unit (i.e., from Tiponi Point and Devil's Playground) may be established for future use. Public access points into the south wilderness unit would not be formalized to maintain the primitive nature of this area. Effects of use on wilderness would be monitored and any adverse impacts would be mitigated. All staff would be trained extensively in safety, wilderness values, and orientation.

Opportunities for solitude and primitive/unconfined recreation:

- Continue policy of no trails and signs, and use camping zones to encourage dispersed use throughout the wilderness area. While there are no designated trails in the wilderness area, Lithodendron Wash provides an avenue for visitor dispersal between the wilderness and backcountry areas.

Access:

- Construct one trail for visitor use in the backcountry in order to provide more formalized access into the north wilderness unit.
- Additional public access points into the north wilderness unit from Tiponi Point and Devil's Playground may be established for future use (see map below).
- Standardize and implement wilderness access points/policies.
- Educate staff regarding south wilderness access points to inform visitors seeking opportunities there.
- Monitor the effects of additional formal wilderness access points on select wilderness values.
- Create trail register and infrared counter for access points into the north wilderness unit to collect more

detailed information about day use visitation. Placement of trail register and infrared counter would occur outside the wilderness boundary.

- Minimize the use of trails and signs (trails, virtual trails, sign, waste management containers, campsites, permits).

Camping:

- Allow dispersed camping in the backcountry during times when Lithodendron Wash is impassible, during inclement weather, or other circumstances deemed necessary by park management (designate a zone 5 for backcountry camping—see map below).
- Delineate existing camping zones on a map in the plan that is used for issuing camping permits.

Interpretation and education:

- Develop media for communicating wilderness values, safety, and appropriate uses to the public. Media could include displays, waysides, books, brochures, videos, and webpages.
- Offer students education about wilderness etiquette and how to conduct research and studies in wilderness areas.
- Enhance interpretive programs and opportunities for wilderness visitors (e.g., ranger walks).

Proposed wilderness regulations changes:

- The types of pack animals that would be allowed in wilderness would be based on the Superintendent's Compendium.
- Dispersed camping in backcountry area (zone 5) would be allowed.
- Human waste management strategy.

Commercial Services

Section 4(d)(6) of the Wilderness Act states, "Commercial services may be performed within the wilderness areas designated by this Act to the extent necessary for activities which are proper for realizing *the recreational or other wilderness purposes of the areas*" [emphasis added]. Section 4(b) of the act further provides that ". . .wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use."

Because the Petrified Forest wilderness area receives low use levels, section 4(b) recreational and educational purposes are not being fully realized by noncommercial use, and therefore, some commercial use could be authorized by the National Park Service to realize that purpose. However, no commercial use activities currently occur in the wilderness area, and the National Park Service is not proposing that commercial services be permitted. Thus, there is no need to limit or allocate commercial use in the Petrified Forest wilderness area. If a commercial service, such as guided trips were proposed, an extent necessary determination would be prepared.

Park Operations

Park operations would actively support increased visitor opportunities resulting from changes in access and awareness about wilderness. Operations staff would receive training in low impact wilderness use (e.g., leave no trace) and wilderness regulations. Proactive activities (e.g., fence repair) would be completed to minimize impacts on the untrammeled quality of wilderness character. Emergency actions (including rescues and carry outs) would be accomplished with minimum impact to park resources by using trained park staff from multiple disciplines. Increased foot and horse patrols would be conducted for the purpose of monitoring use and countering threats to sensitive park resources.

- Greatly improve training for park staff, especially front-line staff, regarding park wilderness, regulations, resources, and opportunities for visitors in the wilderness, resulting in improved visitor education.
- Develop and provide the continuity of an in-house interdivisional education program for as many staff as possible on wilderness values (incorporate into training).
- Train personnel or complete programs on horse use within the wilderness for monitoring or fence repairs.
- Schedule periodic wilderness area foot and horse patrols to monitor evidence of use.
- Recruit volunteers to help with multiple aspects of wilderness management.
- Assist with training staff in issuing backcountry permits.
- Optional administrative access points into the wilderness units would be considered for research and monitoring to prevent the establishment of well-defined administrative trails in the wilderness (i.e., ease of access, efficiency in work, minimize impacts on wilderness qualities such as solitude, trammeling, etc.).

Emergency response:

- Continue emergency response on horseback or by foot to carry out injured visitors from the wilderness area. Emergency response would be consistent with the park emergency response plan, utilizing partnering agencies as appropriate.

Boundary fence:

- Adhere to the programmatic minimum requirements decision guide (appendix D) for maintaining the boundary fence with the least impact to wilderness character.
- Establish a schedule for monitoring fence and access route to determine when maintenance is necessary.
- Manage fences via partnerships with neighbors.
- Develop wildlife-friendly boundary fence to enable species such as pronghorn to pass through.

Scientific research:

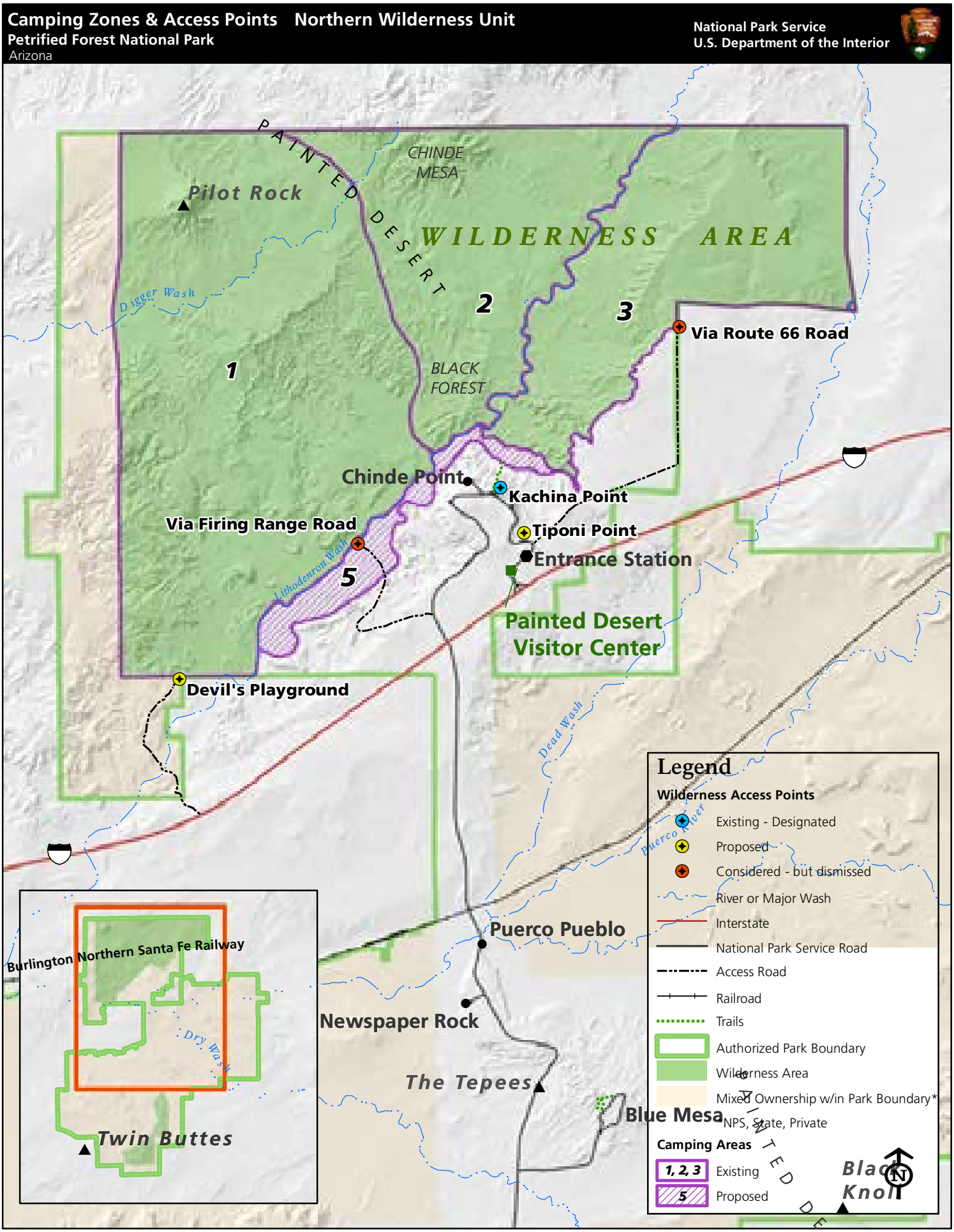
- Adhere to the programmatic minimum requirements decision guide (appendix D) for conducting research within wilderness with the least impact to wilderness character.
- Coordinate park staffs to document sensitive areas in wilderness and monitor sites.

Sanitation / waste management:

- Establish a policy for disposal of human waste in the wilderness and educate visitors.

Partnerships/Outreach

Understanding and awareness about the value of park wilderness would be increased by developing relationships with partners and stakeholders. The park would build lasting relationships with a variety of partners including local, regional, political, tribal, educational institutions, etc. Outreach would include partnering with wilderness education experts (e.g., leave no trace) and with the wilderness community at large (e.g., Arizona Wilderness Commission).

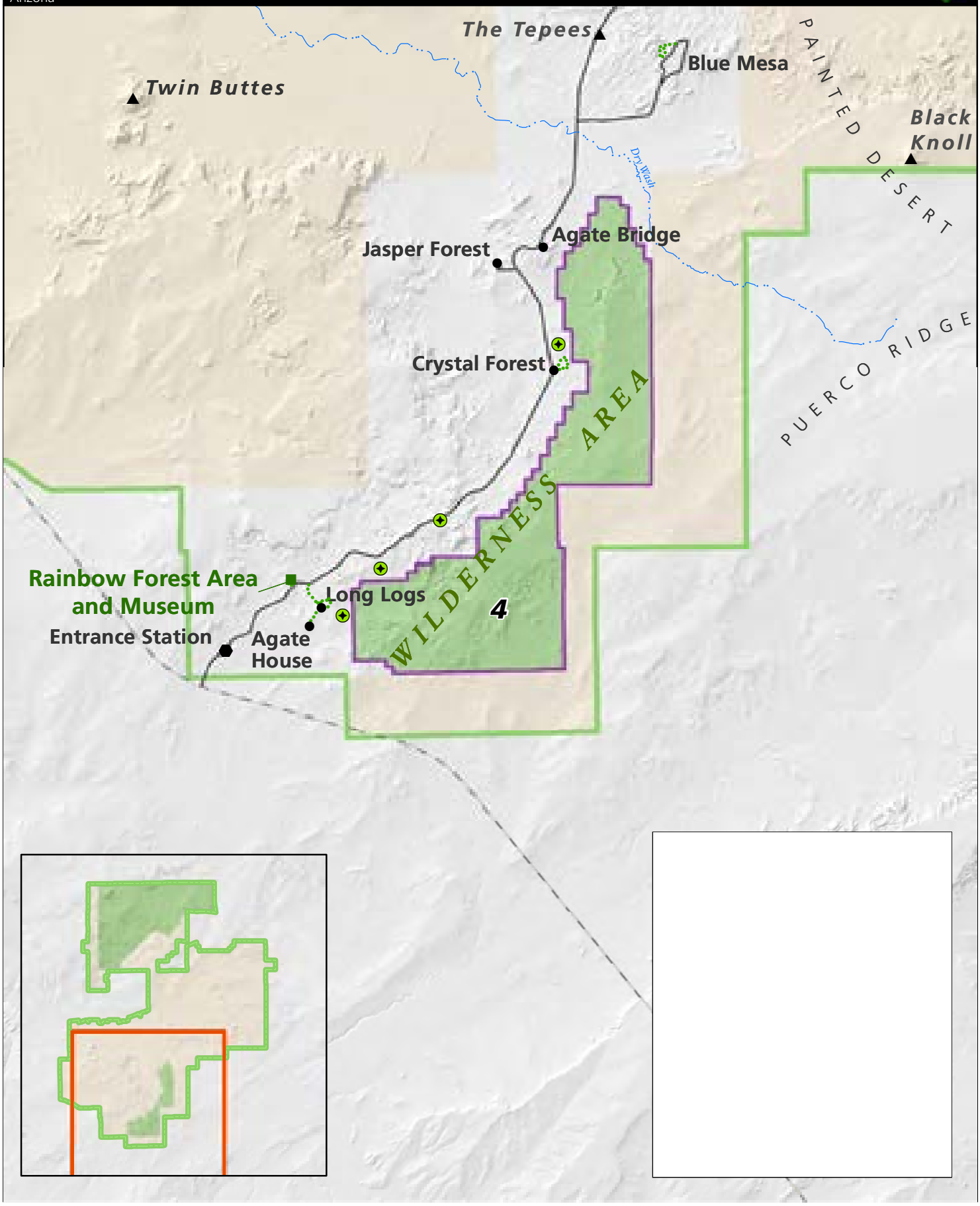


Produced by: NPS Denver Service Center Planning Division
October 2012

Camping Zones & Access Points Southern Wilderness Unit

Petrified Forest National Park
Arizona

National Park Service
U.S. Department of the Interior



Produced by: NPS Denver Service Center Planning Division
October 2012

0 0.5 1 2 3 Miles

The park would build a constituency by cultivating interested citizens and encouraging community involvement. Development of a friends group could help expand partnerships with other organizations, and existing relationships would be strengthened. Partners would be enlisted to assist with restoration efforts in wilderness units. Partnerships with the Navajo Nation along the shared boundary would be strengthened. Increased outreach would occur with neighbors, especially those that could potentially impact wilderness character.

- Encourage visitors to engage in wilderness management and education, and ask visitors to report their observations (volunteer basis).
- Take advantage of internship programs and cooperative agreements that offer students wilderness management experiences that assist the park.
- Work with neighboring properties to manage invasive plants (tamarisk) including the Navajo Nation near the north wilderness unit.
- Manage fences via partnerships with neighbors.
- Build partnerships with neighbors to help protect wilderness values along the edge of the wilderness area.
- Increase public profile of the park wilderness through expanded community outreach (including popular media).
- Use partnerships and potential friends groups to conduct scientific research in wilderness areas.

Guiding Management Principles to Address Climate Change

The "guiding management principles to address climate change" contained in the park's recent general management plan amendment (2010) would be tailored to the monitoring and protection requirements of park wilderness units. The following outlines these management principles and sets forth a path for integrating them into wilderness management as feasible.

- Identify key resources and processes that are at risk from climate change.
  - Determine what aspects of the five wilderness qualities (untrammeled, natural, undeveloped, opportunities for primitive and unconfined types of recreation, and other features and values) are at risk from climate change.
- Establish baseline resource conditions, identify thresholds, and monitor for change.
  - Identify specific "measures" that are best suited for monitoring climate change and its influence on wilderness resources. Measures track conditions to assess progress toward attaining desired conditions and preserving wilderness character. They are the specific aspects of wilderness on which data are collected.
- Assess, plan, and manage resources at multiple scales.
  - Determine what scales are most appropriate for assessing, planning, and managing for wilderness resources. For example, regional monitoring of climate conditions can be used to track trends throughout the Arid Lands Bioregion and the Southern Colorado Plateau and then applied to wilderness-specific management strategies at Petrified Forest National Park.
- Form partnerships with other resource management entities to maintain regional habitat connectivity and refugia that allow species dependent on park resources to better adapt to changing conditions.

  - Identify partners to assist in addressing regional habitat connectivity to the park wilderness area in order to increase the resilience of wilderness resources to withstand climate change-related impacts. Partnerships would be sought to assist with research efforts, implementing management strategies, providing funding sources, outreach, information sharing, and general collaboration.
- Increase reliance on adaptive management to minimize risks to park resources.
  - Incorporate adaptive management strategies to minimize the risk of climate change on wilderness resources. For example, if erosion increases and exposes more fossils due to climate change, efforts would be increased to monitor and collect fossils as appropriate. Also, with increased periods of drought, efforts may be increased to partner with adjacent landowners to provide wildlife-friendly fencing and thus protect wildlife migration corridors.
  - Utilize scenario planning tools to better prepare park managers in adapting to climate change.
- Use best management practices to reduce human-caused stresses that hinder the ability of species or ecosystems to withstand climatic events.
  - Develop best management practices to reduce human-caused stresses in and surrounding the wilderness areas that hinder the ability of park managers to protect wilderness qualities in light of climate change effects. For example, explore options for the existing boundary fence to improve pronghorn movement, which is essential for their adaptation to prolonged drought conditions.
- Restore key ecosystem features and processes to increase resiliency to climate change.
  - Determine if management actions are needed to promote the resilience of wilderness resources to absorb climate change effects and still persist without undergoing a fundamental loss of character.
- Reduce or mitigate greenhouse gas emissions associated with park operations and visitor use (i.e., park carbon footprint).
  - Incorporate strategies for reducing emissions related to park operations and visitor use of wilderness areas. For example, visitor-related emissions are primarily associated with travel to and within the park. Suggested strategies may include educational messaging to encourage more sustainable transportation.

APPLYING THE MINIMUM REQUIREMENTS CONCEPT

Under the provisions of the Wilderness Act, NPS *Management Policies 2006* (6.3.5) and Director's Order 41 (NPS 1999), all management decisions affecting wilderness must be consistent with the minimum requirement concept. This concept is a documented process used to determine if administrative actions, projects, or programs affect wilderness character, and if so, how to minimize impacts. The minimum requirement concept is used to determine

- whether the proposed management action is appropriate or necessary for administration of the area as wilderness and does not cause a significant impact to wilderness

resources and character, in accordance with the Wilderness Act

- the techniques, tools, and equipment needed to ensure that impacts on wilderness resources and character are minimized

The concept of minimum requirements comes from section 4(c) of the Wilderness Act of 1964:

> Except as specifically provided for in this Act, and subject to existing private rights, there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and except as necessary to meet *minimum requirements* for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.

The National Park Service applies the minimum requirement concept in the context of wilderness stewardship planning, as well as to all other administrative practices, proposed special uses, scientific activities, and equipment use in wilderness. (Where actions take place outside the wilderness, consideration should also be given to how those actions may have indirect effects on wilderness character.) Completion of the minimum requirements analysis is part of the environmental screening process and accompanies the appropriate environmental compliance, and may be subject to public review prior to approval.

When determining the minimum requirement, the potential disruption of wilderness resources and character is considered before, and given more weight than, economic efficiency and convenience. If a compromise of wilderness resources or character is unavoidable, only those actions that preserve wilderness character in the long run and/or have localized, short-term, adverse impacts are accepted.

The second part of the minimum requirement concept is identifying the minimum tool, which is defined as the least intrusive tool, equipment, device, force, regulation, or practice that would achieve the wilderness management objective safely and with the least impact on wilderness resources.

Minimum Requirements Decision Guides

Ordinarily each proposed management action is evaluated separately through its own minimum requirements analysis. The typical minimum requirement analysis worksheet is in appendix D.

Due to the frequency of paleontological and archeological research and boundary fence maintenance within the park wilderness area, two programmatic "minimum requirements decision guides" have been prepared as part of this planning effort. These MRDGs, including an evaluation of a range of management options, are included in appendix D. Actions that would ordinarily be prohibited in wilderness (e.g., the use of mechanized or motorized transport to expedite the safe removal of fossils / archeological materials, or the maintenance of the boundary fence), would only be permitted in limited, exceptional instances when manual, horseback, or other nonmechanized methods could not be realistically employed without incurring resource damage or further compromising wilderness values. Park managers, resource specialists, and other appropriate NPS staff would thoroughly review proposed undertakings and would only authorize section 4(c) prohibited actions after first assessing minimal tool requirements. The relative advantages and disadvantages of using particular tools, equipment, and methods would be assessed

and the park would select actions that best achieve project objectives with the least impact to wilderness character.

Research Activities

A programmatic minimum requirements decision guide has been prepared to address the excavation and removal of specimens and artifacts that are discovered during paleontological and archeological research within the Petrified Forest National Park Wilderness Area. With regard to paleontological research, the decision guide only applies to specimens that are too fragile or heavy to excavate and remove without using section 4(c) prohibited uses. For example, fossils are often preserved in large plaster jackets that can weigh hundreds of pounds. In addition, the removal of especially fragile specimens from encasing rock using hand tool methods can cause excessive vibration that can damage or destroy specimens. The decision guide also applies to methods of archeological research that may require the excavation and removal of cultural artifacts and other materials that cannot be adequately preserved *in situ*.

This alternative would permit a minimal use of hand-held power tools to excavate paleontological specimens. Archeological investigations could use remote-sensing devices such as ground penetrating radar. Nonmotorized wheeled conveyances could be used for removal of paleontological specimens and recovered archeological resources. The size and weight of specimens and their location may require the use of additional prohibited methods. If a nonmotorized wheeled conveyance does not adequately permit specimen removal, a utility task vehicle, or motorized wheelbarrow may be used in dry washes for transport. In extreme cases when the specimen is particularly heavy, the use of a truck may be required in dry washes. The use of a helicopter may be required when the specimen is exceptionally heavy and in an area inaccessible to a wheeled vehicle. Use of a vehicle in a dry wash is preferred because water runoff in the washes more easily erases evidence of vehicle tracks.

Boundary Fence Maintenance

A programmatic minimum requirements decision guide has been prepared to address maintenance of the boundary fence within the Petrified Forest National Park Wilderness Area. It is necessary to maintain the wilderness boundary fence to protect wilderness character. The fence prevents the trespass of livestock and recreational ATVs. Trespass livestock and recreational vehicles disturb the natural quality of wilderness character because they represent effects of modern technological civilization on natural ecological systems.

The boundary fence is just inside the wilderness area boundary, so maintenance must occur within wilderness. However, access could be obtained through neighboring properties in the future. This would require obtaining permission and determining appropriate routes in order to access wilderness via private property.

Under this alternative, people and pack animals would be used to the greatest extent possible to carry the wire, posts, and the equipment needed to repair/replace the fence over several miles of rough terrain to the work site. However, if repair work is extensive, a utility task vehicle would be permitted to carry personnel, wire, posts, and the equipment needed to repair/replace the fence over several miles of rough terrain to the work site. To the extent possible, the utility task vehicle would stay on an existing road trace to prevent impacts on vegetation. The vehicle would only make as many trips as necessary to bring equipment.

This approach was determined to best address the criteria for preserving the qualities contributing to park wilderness character. Because trespass livestock and vehicle intrusions can cause severe and adverse effects to the untrammeled, natural, and

solitude or primitive recreation qualities of wilderness, it was determined that maintaining the boundary fence was more protective of wilderness character than not maintaining the boundary fence.

WILDERNESS CHARACTER MONITORING FRAMEWORK AND USER CAPACITY

INTRODUCTION

This section of the plan identifies the user capacity and wilderness character measures, standards, and management strategies for the Petrified Forest National Park wilderness area. The components are defined and described as follows:

- Indicators and related measures specify conditions to be assessed for progress at attaining goals and objectives, preserving wilderness character, and satisfying user capacity requirements.
- Standards (either qualitative or quantitative) guide management decisions on the minimum acceptable condition for measures and serve as triggers for management action.
- Management strategies comprise a toolbox of options considered for implementation in order to maintain or restore conditions according to management goals and objectives.

In the context of wilderness, the concept of user capacity is defined as the types and levels of visitor use that can be accommodated while sustaining the quality of park resources and visitor experience that are consistent with protecting wilderness character. Therefore, user capacity is being adopted as part of the wilderness stewardship plan. Wilderness character monitoring is a separate process that consists of choosing measures that represent a relevant and cost effective way to determine how wilderness character is changing over time (Landres et al. 2008). Both the 1964 Wilderness Act and NPS *Management Policies 2006* require monitoring natural and cultural resource conditions and long-term trends in wilderness character.

The frameworks used for addressing user capacity and wilderness character have the same goal of protecting resources (natural, cultural, and visitor experience) through monitoring established measures and determining if the conditions are approaching the designated standard. User capacity focuses solely on visitor use and the associated impacts to resources and visitor experience, whereas wilderness character monitoring focuses more holistically by evaluating any potential impacts including administrative and visitor use. For this plan, the wilderness character monitoring framework was overlaid on the user capacity requirements because the former encompasses the latter. Wilderness character monitoring at the park, when combined with similar information from other parks, provides a tool for understanding trends of wilderness character in the region and across the national park system. This function is distinct to the wilderness character framework.

Given the broad scope of wilderness character measures across the five wilderness qualities, limited existing data for certain measures, and the fact that some of the conditions being evaluated are outside NPS management control, some standards are qualitative and assess changes in trends, while other standards are quantitative, measurable variables. The qualitative changes in trends and quantitative standards trigger the modification or initiation of management actions. Most of the visitor use-related standards are quantitative because management of visitor use is largely within the agency's management control (Sharp, Cahill, and Sharp 2012).

The frameworks for wilderness character and user capacity are forms of adaptive management in that they are iterative processes in which management decisions are

continuously informed and improved. Measures will be monitored, conditions will be compared to standards, and management strategies will be adjusted as appropriate. The goal of this adaptive management process is to protect the five qualities of wilderness character through informed, proactive, and transparent management. With a meaningful set of measures, standards, and management strategies, these elements collectively support protection of the management goals and objectives for wilderness character.

USER CAPACITY

Managing user capacity in national parks is inherently complex and depends not only on the number of visitors, but also on where the visitors go, what they do, and the "footprints" they leave behind. In managing user capacity, park staff and partners rely on a variety of management tools and strategies rather than relying solely on regulating the number of people in a park or area. In addition, the ever-changing nature of visitor use in parks requires a deliberate and adaptive approach to user capacity management. The measures, standards, and management strategies help ensure visitor use is being managed to protect wilderness values, therefore supporting the fulfillment of legislative and policy mandates.

With regard to use levels, Petrified Forest National Park received 664,725 visitors in 2010, with 300 of those visitors camping in the backcountry, or wilderness areas. The low overnight use levels could be a result of a variety of factors including the harshness of the desert environment, lack of permanent water sources in the wilderness, and uncertainty about wilderness boundaries and camping locations within the park. This level of use is currently monitored through overnight backcountry permitting. However, park staff knows very little about day use in wilderness. Day use visitation to the north wilderness unit would be monitored via a voluntary trail register that would be installed as a result of this planning effort. Based on the existing NPS knowledge of resource and social conditions within the park, current use levels allow the National Park Service and its partners to protect resources and provide high quality visitor experiences, including achieving management goals and objectives and meeting the measures and standards outlined in table 3. There are some impacts occurring from visitor use that will largely be addressed in this plan through education and site management tools.

Given the factors noted above, use levels and patterns are not expected to change substantially over the life of this plan. Since use levels in the wilderness are low, an increase in use could likely be accommodated in the future. Nevertheless, changes in visitor use patterns and associated impacts to resources would be monitored to ensure that NPS commitments to park legislative and policy mandates, management goals and objectives, and related standards are being achieved. It is anticipated that if use levels increased, the solitude and primitive and unconfined types of recreation would be the wilderness value most likely sensitive to adverse impacts. This would be a result of increased contacts between visitors and possibly trampling of sensitive soils, which would degrade the natural setting for visitors. This would affect the current high levels of solitude and sense of remoteness found in the wilderness. The measures and standards in table 3 will help park staff track changes in these visitor experience and resource conditions to determine if increases in use levels or patterns are having effects on management goals and objectives.

WILDERNESS CHARACTER MONITORING

Monitoring wilderness character is important for several reasons: (1) to comply with the law (the Wilderness Act), (2) to fulfill agency policy (NPS *Management Policies 2006*), and (3) to improve wilderness stewardship. The Wilderness Act states that wilderness areas "shall be administered for the use and enjoyment of the American people in such

manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character . . ." NPS *Management Policies 2006* states, "Management will include the protection of these (wilderness) areas, for the preservation of their wilderness character. . ." (NPS 2006a). Since the majority of the park is federally designated or eligible wilderness, monitoring wilderness character is essential to protect the properties that make Petrified Forest National Park unique.

Wilderness character is described as five necessary and interrelated qualities: untrammeled, natural, undeveloped, solitude or primitive and unconfined recreation, and other features and values (Landres et al. 2008; NPS 2012). Together, the five qualities comprise an integrated ecological and social system of wilderness. See chapter 1 for a description of the five qualities.

The five qualities of wilderness character capture the intent that Congress put forth in the Wilderness Act as well as the guidance in NPS *Management Policies 2006*. Both point to monitoring conditions and long-term trends in wilderness character. The *Keeping It Wild* (Landres et al. 2008; NPS 2012) framework was used as a guide in this process. The purpose of the *Keeping It Wild* framework is to improve wilderness stewardship by providing managers with a tool to assess how wilderness character is changing over time. Identifying wilderness character through this framework is integral to meeting the goals and objectives of this plan.

The planning team considered many potential measures that would identify impacts of concern, but those described in table 6 were considered the most significant, given the importance and vulnerability of the resources or visitor experiences affected. After prioritization, the team refined the language for all measures to ensure that they were reliable, measureable, and manageable for long-term monitoring efforts. The final step of the process focused on identifying draft standards for each of the selected measures, along with associated management actions that would be used if standards were exceeded. Standards represent the minimum acceptable condition of the *measure* variables where adjustments in current management or additional actions would be required to further protect wilderness character. The wilderness monitoring framework shown in table 3 illustrates measures, standards, and management actions.

Initial monitoring would determine if the measures are accurately measuring the conditions of concern and if the standards truly represent the minimally acceptable condition. The park staff might decide to modify the measures or standards and revise the monitoring program if better ways are found to measure changes in wilderness character. Most of these types of changes should be made within the first several years of initiating monitoring. After this initial testing period, adjustments would be less likely to occur. Finally, if conditions change appreciably, park staff might need to identify new measures to ensure that wilderness character desired conditions are achieved and maintained. Information on the NPS monitoring efforts and any changes to the measures and standards will be shared with the public.

Although the staff would continue monitoring wilderness character measures and standards throughout the park, the rigor of monitoring (e.g., frequency of monitoring cycles, amount of geographic area monitored) might vary considerably depending on how close existing conditions are to the standards. For instance, if the existing conditions are far from exceeding the standard, the rigor of monitoring might be less than if the existing conditions are close to or trending toward the standard.

MEASURES, STANDARDS, AND MANAGEMENT STRATEGIES FOR THE FIVE QUALITIES OF WILDERNESS CHARACTER

The following section provides the rationale for the various measures, standards, and management strategies presented in table 3. The measures and standards are based on both scientific research and best professional judgment. The strategies presented in the text and table are not an exhaustive list, nor are they necessarily in priority order. However, the strategies give an indication of the kinds of tools NPS staff will use to preserve wilderness character.

Untrammeled Quality

The measures for the untrammeled quality of wilderness character focus on authorized and unauthorized actions undertaken by federal land managers and others, respectively, that manipulate the biophysical environment. These measures include:

- number of projects per year to treat invasive plant species
- number of square feet of disturbed area due to paleontological and archeological activities
- number of incidences of livestock or ATVs (or their evidence) observed in the wilderness per year

Number of projects per year to treat invasive plant species. Tracking the number of projects per year to treat invasive plant species would measure the extent of nonnative plant management in the wilderness, and would provide useful information about trends over time. A current decrease in the number of acres treated per year could indicate that the trend for this measure is improving. Specific data pertaining to invasive plant management are maintained by the exotic plant management team in park staff logs. However, treatment has been sporadic and it will take more time to test for effectiveness of treatment. Park staff aim to limit the number of times that the exotic plant management team make trips into the wilderness to reduce the potential of impacts to the untrammeled quality. Therefore, the standard was set to no more than three restoration projects per year per 20 acres of wilderness. If this standard is reached, management strategies may include increased education to team members to reduce impacts resulting from restoration work and increased partnerships with neighboring landowners to exclude the introduction of invasive species into the wilderness area.

Number of square feet of disturbed area due to paleontological and archeological activities. Understanding if disturbances are occurring during paleontological and archeological activities is important because it tracks how park research activities could affect wilderness values. Because of the increased size of disturbed areas, the trend in this measure is degrading. Detailed paleontological and archeological notebooks, end of year reports, and photos document this type of research being conducted in wilderness. To maintain the integrity of the wilderness and prevent impacts to the untrammeled wilderness quality, a standard of no more than 400 square feet of disturbed area per year was set. If conditions reach the standard, management strategies may include educating researchers about ways to reduce impacts in wilderness and mitigation measures such as revegetation and recontouring the disturbed site.

Number of incidences of livestock or ATVs (or their evidence) observed in the wilderness per year. This measure tracks known incidences of livestock and ATV trespass into wilderness. The trend in this measure is generally improving, and park staff have noticed that incidences of trespass seem to be decreasing. Incidences of trespass are currently tracked with formal law enforcement reports and other informal resource damage reports. The standard for incidences of trespass was set to no more than one per year. If more than one incident

occurs, management strategies would become more stringent until the issue is under control. Currently, any sighting of livestock or ATVs in the wilderness triggers management actions such as fence repair and law enforcement. If problems persist, increased education of park neighbors, monitoring of the fence, and increased patrols of the wilderness would occur.

Natural Quality

The measures for the natural quality of wilderness character focus on effects from modern civilization on wilderness ecological systems. This includes plant and animal species, physical resources, and biophysical processes. These measures include:

- changes in abundance and distribution of invasive species (e.g., tamarisk)
- changes in visibility
- ozone air pollution based on primary and secondary U.S. Environmental Protection Agency (EPA) standards
- changes in plant species composition (as related to climate change) in the wilderness area in collaboration with external partners (Inventory and Monitoring Program [I&M] and National Oceanic and Atmospheric Administration [NOAA])

Changes in abundance and distribution of invasive species (e.g., tamarisk). This measure evaluates the number of invasive plant and animal species, including tamarisk. Because of increasing invasive populations, the current trend for this measure is degrading. Information related to invasive species is tracked through the exotic plant management team surveys and databases, and by the NPS I&M program. The standard was set to no more than 5% increase in the range of existing invasive species density per acre. Management strategies include the use of citizen scientists to assist with identifying the location of invasive species and future eradication. Increased education for visitors could also assist with problems (i.e., weed-free feed for pack animals). Finally, invasive species control, removal, and revegetation measures would occur in the backcountry and wilderness areas.

Changes in visibility. Visibility is a measure of how far and how well we can see a distant and varied scene; pollutant particles in the atmosphere degrade scenic views by scattering and absorbing light (i.e., light extinction). Petrified Forest National Park is a designated class I area under the Clean Air Act, which provides a high level of protection for visibility (as well as air quality and park resources sensitive to air pollution). Visibility in class I areas is regulated by the Regional Haze Rule; the IMPROVE monitoring program collects and maintains these data (IMPROVE 2012). Visibility is also protected as part of the National Ambient Air Quality Standards particulate matter secondary standard, which is currently set equal to the primary health standard. Information regarding visibility is maintained by the NPS Air Quality Division and the Clean Air Status and Trends Network (CASTNET). Impacts to visibility in Petrified Forest National Park is considered to of moderate concern by the NPS Air Quality Division.

The visibility measure in this plan tracks visibility based on average deciview and the sum of anthropogenic fine nitrate and sulfate. Deciview is a measure in a visibility (haze) index developed to uniformly describe levels of monitored and modeled visibility impairment and to assess the progress of visibility protection programs. The scale of this visibility index, is linear with respect to perceived visual changes over its entire range, analogous to the decibel scale for sound. As the index increases, visibility worsens. The trend for this measure is currently stable—visibility is neither increasing or decreasing. To protect visibility under this monitoring framework, the standard for this measure was based on national standards. If conditions for visibility approach national standards, management strategies will be enacted. These

include educating the public about sources of pollution that reduce visibility, evaluating and reducing the contribution to pollution from the park, and working with the NPS Air Quality Division to develop more extensive air quality improvement strategies.

This measure tracks visibility based on average deciview and the sum of anthropogenic fine nitrate and sulfate. Deciview is a visibility index developed to uniformly describe levels of monitored and modeled visibility impairment and to assess the progress of visibility protection programs. The scale of this visibility index, expressed in deciview (dv), is linear with respect to perceived visual changes over its entire range, analogous to the decibel scale for sound. The trend for this measure is currently stable, and information regarding visibility is maintained by the NPS Air Quality Division and the Clean Air Status and Trends Network. To protect visibility under this monitoring framework, the standard for this measure was based on national standards. Visibility in class I areas (essentially national parks and wilderness areas) is regulated by the Regional Haze Rule; the IMPROVE monitoring program collects and maintains these data (IMPROVE 2012). Visibility is also protected as part of the National Ambient Air Quality Standards particulate matter secondary standard, which is currently set equal to the primary health standard. If conditions for visibility approach national standards, management strategies will be enacted. These include educating the public about sources of pollution that reduce visibility, evaluating and reducing the contribution to pollution from the park, and working with the NPS Air Quality Division to develop more extensive air quality improvement strategies.

Ozone air pollution based on primary and secondary EPA standards. This measure tracks ozone air pollution based on EPA guidance (EPA 2012). Ozone is a pollutant formed when nitrogen oxides combine with volatile organic compounds in the presence of sunlight. Ozone is a human health concern and can harm vegetation by reducing photosynthesis. Plants are much more sensitive to ozone than humans, and can be harmed at lower levels. Information regarding ozone air pollution is maintained by the NPS Air Quality Division and the Clean Air Status and Trends Network. To protect air quality under this monitoring framework, the standard for this measure complies with national standards.

The Clean Air Act, which was last amended in 1990, requires the Environmental Protection Agency to set National Ambient Air Quality Standards (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act identifies two types of national ambient air quality standards. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air ("g/m3). The primary and secondary standards for ozone are based on an 8-hour averaging time. The national standard is 0.075 ppm annual fourth-highest daily maximum 8-hour concentration averaged over three years. Current ozone levels in the park are considered to be a moderate concern by the NPS Air Quality Division. The trend for this measure is currently stable—neither increasing or decreasing. If conditions for ozone air pollution approach this standard, management strategies will be enacted. These include educating the public about sources of ozone air pollution, evaluating and reducing park contribution to pollution, and working with the NPS Air Quality Division to develop more extensive air quality improvement strategies.

Changes in the plant species composition (as related to climate change) in the wilderness area in collaboration with external partners (I&M and NOAA). This

measure evaluates changes in plant species composition due to climate change. The trend for this measure is currently unknown. However, extensive monitoring and data collection will likely reveal the effects of climate change over time. A variety of programs have been tracking this information including the Colorado Plateau Cooperative Ecosystems Studies Unit, the NPS I&M program, National Oceanic and Atmospheric Administration, the National Trends Network, and CASTNET. A qualitative standard for this measure was established stating that if trends increase for loss of climate-related indicator plant species existing in wilderness, or if a change in the native range of species occur, then manage-ment strategies would be initiated. Possible strategies include educating the public about climate change and its effects on wilderness values, evaluating and reducing park contributions to climate change, and working with partners to monitor and reduce the effect of climate change on wilderness values.

Undeveloped Quality

The measures for the undeveloped quality of wilderness character focus on effects to the primeval character of wilderness including improvements or influences from human occupation. Examples include nonrecreational structures, installations, and developments, use of motorized equipment or mechanical transport, and the loss of statutorily protected cultural resources. Specific measures developed for this monitoring framework include:

- number of developments found in the wilderness (currently none exist)
- number of occurrences of administrative and nonemergency use of motorized equipment or mechanical transport (e.g., boundary fence maintenance, collection and removal of paleontological and archeological specimens)

Number of developments found in the wilderness (currently none exist). This measure evaluates the number of developments found in wilderness. The current trend for this measure is stable because no developments exist in the wilderness area. However, a measure and standard were developed to ensure the long-term integrity of the undeveloped quality. A qualitative standard was set clarifying that if proposals for development in wilderness occur, then management strategies would be discussed. The ideal standard is that no developments would exist in wilderness. If options for development were considered, park staff would seek alternative management strategies. For example, if social trails begin to occur in wilderness, park staff would encourage dispersed use to prevent the need for developing trails in wilderness. Another useful strategy would be to increase visitor education about wilderness etiquette.

Number of occurrences of administrative and nonemergency use of motorized equipment or mechanical transport (e.g., boundary fence maintenance, collection and removal of paleontological and archeological specimens). This measure evaluates the number of occurrences of administrative and nonemergency use of motorized equipment or mechanical transport, and includes boundary fence maintenance and collection and removal of paleontological and archeological specimens. The current trend for this measure is stable because these actions are ongoing and occur at a relatively low frequency. Records of motorized use and mechanical transport are tracked via administrative records and research permits issued for wilderness activities. The standard for this measure was set to no more than three occurrences per year with approved minimum requirements review per wilderness unit. The goal for this standard is to ensure that no net long-term decrease to wilderness character occurs. Detailed guidance can be found in the programmatic minimum requirements decisions guides for boundary fence maintenance and research activities in

appendix D of this document. If standards are reached for this measure, possible management strategies include conducting annual planning meetings to prioritize which activities will occur in wilderness, continuing review of minimum requirements decision guides to ensure appropriate approvals, and providing staff training for use of nonmechanized tools.

Solitude or Primitive and Unconfined Recreation Quality

The measures for this quality of wilderness character help ensure that opportunities for solitude or primitive and unconfined recreation exist in wilderness. This includes a focus on remoteness from sights and sounds of people inside of wilderness, remoteness from occupied and modified areas outside of wilderness, facilities that decrease self-reliant recreation, and management restrictions to visitor behavior. Specific measures developed for this monitoring framework include:

- number of people going into the wilderness
- evidence of human disturbance in wilderness
- light pollution
- percent time audibility of extrinsic noise
- viewshed intrusions
- type and number of agency-provided recreation facilities
- type and number of management restrictions

Number of people going into the wilderness. This measure tracks the number of people using the wilderness area. By understanding the amount and location of use occurring, managers can better understand the opportunities for visitors to obtain remoteness from sights and sounds of other people. Because there are few resource impacts caused by visitors in wilderness, and few complaints from visitors about opportunities for solitude or primitive recreation, managers have concluded that use is at a stable level. Trends for overnight use in wilderness are tracked via the overnight camping permit system. From 2005 to 2010, overnight use levels remained low, never exceeding 300 campers per year. Trends for day use in wilderness are currently unknown. However, park staff would like to install a trail register to better understand visitation trends in the north wilderness unit, since most visitors are directed to that area. Because little is known about the number of day use visitors to wilderness, park staff have established a standard that will be adaptively adjusted as data on use is collected.

Current knowledge and evidence of wilderness conditions indicate that both resource and visitor impacts resulting from use are not an issue of concern. However, managers will proactively track visitation to ensure that the amount of use does not cause impacts to wilderness values over time. The preliminary standard has been established indicating that a five-year increase in trail register numbers would trigger management action. After park managers gain a better understanding of trends in wilderness, this standard may need to be adjusted to ensure continued opportunities for solitude or primitive and unconfined types of recreation in wilderness. If standards are exceeded, management strategies would be initiated. Possible strategies include increased patrols to monitor distribution of use (including distribution and location), verifying the number of visitors with site counts, conducting a detailed visitor survey to understand visitor perceptions and use patterns. Depending on resulting data from the trail register, other strategies may need to be developed to educate visitors about wilderness values and to disperse use in the future.

Evidence of human disturbance in wilderness. This measure tracks evidence of human disturbance in wilderness such as rock cairns, vandalism, footprints, trash, visitor

created trails, human waste, etc. The current trend for this measure is stable, with some human-related impacts occurring in wilderness. In particular, there are impacts to the biological soil crusts in the transition areas between the backcountry zone and the north wilderness unit. Data pertaining to human disturbance was collected during a rapid site inventory (Foti 2006), and measures and standards were established by mirroring methodology used in this protocol. Using the Foti (2006) report as a baseline, the standard was set to stipulate that 90% of sites would fall into the unimpacted or slightly impacted category. Unimpacted sites have little to no disturbance to vegetation or organic litter, and biological soil crusts, if present, are intact. No litter, social trails, or access trails are present at unimpacted sites. Slightly impacted sites show evidence of use. Organic surface disturbance may be apparent in the form of one or two tent sites or social trails. There is little to no macrotrash, and there is minimal disturbance to vegetation, soil crusts, and rocks. Detailed information about rapid site inventory techniques can be found in *A Report of the Wilderness and Backcountry Recreation Impacts for Petrified Forest National Park* (Foti 2006). If standards are reached, management strategies would be initiated. Possible strategies include better education of wilderness visitors, increased monitoring and patrols, sending cleanup crews to problem areas, and encouraging dispersed use.

Light pollution as measured with established methods from night sky program / inventory and monitoring program. This measure tracks light pollution using established methods developed by the NPS Natural Sounds and Night Skies Division. Current trends in this measure are degrading and threatened by external developments that are occurring both near and far. Baseline night sky data collection has occurred at Petrified Forest National Park, and is in the queue for analysis by the NPS Natural Sounds and Night Skies Division. Findings will help detect long-term changes and will provide scientifically sound data for wilderness stewardship. The preliminary standards established for this measure stipulate that an increase in light pollution would be ≤ 10 % above baseline. If standards are reached, management strategies would be initiated. Possible strategies include proactively working with local industry and neighbors to promote dark night skies and to encourage compliant technology. The park would also work internally to ensure continued compliance with dark sky lighting. Other possibilities include the creation of an educational campaign, which would communicate the issues associated with light pollution.

Percent time audibility of extrinsic noise. This measure evaluates the percentage of time that extrinsic, or human caused noise, is audible. Noise refers to any human-caused sound that masks or degrades natural sounds (Lynch et al. 2011). Tracking this measure informs park managers of the opportunities available for visitors to experience solitude and remoteness from occupied and modified areas outside of wilderness. The current trend in this measure is stable, but threatened by external developments. Trends were determined using acoustical data collected in the Painted Desert during September 2004 and March 2010, and indicate that acoustic conditions are highly impacted by noise from aircraft overflights. The standards presented in table 3 represent a considerable improvement to those conditions. The standard established for this measure specifies that the hourly percent time audible of human caused noise would be ≤ 10% for 90% of the day (this allows for flexibility due to unanticipated and short-term fluctuations in noise). Additionally, the hourly percent time audible should never exceed 30%. This standard would be protective of wilderness values for the summer and the winter season, and establishes a point of leverage for when new developments pose threats to the soundscape. The standard represents realistic and attainable conditions; however, achieving the referenced conditions will likely take several years of focused and effective management actions including working closely and cooperatively with the Federal Aviation

Administration to address noise effects from overflights. If standards are reached, adaptive management strategies would be initiated. This includes the incorporation of soundscape information into wilderness educational materials. Additional strategies include encouraging visitors to appreciate the natural sound environment and limit the use of artificial sounds and other noise made in wilderness. Other strategies include educating visitors about reducing sounds outside of wilderness that could be heard from wilderness (e.g., car alarms).

Viewshed intrusions as measured with established viewshed analysis procedures. This measure evaluates the extent and magnitude of intrusions on the viewshed. Tracking this measure informs park managers of the opportunities for visitors to experience a sense of solitude due to nonvisibility of outside developments. The current trend in this measure is degrading due to existing external developments and the likelihood of additional developments in the vicinity of the wilderness area. A quantitative standard was not established for this measure because management strategies would be initiated right away and would continue as part of regular park business. Strategies include the creation of an educational campaign to communicate the issue of viewshed intrusions into wilderness, and proactively working with neighbors and local industry to encourage wilderness-friendly viewshed projects. It is important to note that the viewshed extends over 100 miles in some cases, and there are realities to the amount of influence the National Park Service may have in minimizing external developments.

Type and number of agency-provided recreation facilities. There are currently no agency-provided facilities or trails in wilderness, and the management team does not anticipate a need for developments. However, this measure would track the type and number of agency-provided recreation facilities that might be considered by the management team. The standard for this measure affirms that there would be no new installations in wilderness without minimum requirements analysis and approval. Management strategies to ensure regulation of agency provided facilities include continued use of minimum requirement decision guides, and increased management enforcement and accountability.

Type and number of management restrictions. This measure evaluates the type and extent of management restrictions on visitor behavior. Tracking this measure would inform park managers of possible impacts to visitor experiences of primitive and unconfined types of recreation. The current trend for management restrictions is stable because there are limited restrictions on visitors throughout the wilderness area, and the lack of infrastructure provides for primitive and unconfined types of recreation (e.g., no trails, signs, or designated campsites). The standard for this measure stipulates that there would be no new restrictions to visitors without careful consideration of impacts on wilderness character.

Other Features and Values

The measure for the fifth quality of wilderness character (other features and values) focuses on deterioration or loss of cultural resources or paleontological resources. This measure includes:

- number of instances of illegal or unauthorized collection/damage to archeological or paleontological resources

Number of instances of illegal or unauthorized collection / damage to archeological or paleontological resources. This measure tracks incidences of illegal or unauthorized collection and damage to archeological and paleontological resources. The current trend for this measure is difficult to determine, but likely stable. Trends are tracked through formal law enforcement reports and other informal

resource damage reports. The standard was set to no incidences of collection/ damage would be acceptable each year. Therefore, each additional incident would trigger a higher intensity of management strategies. Any incident of collection or damage of resources currently triggers management actions such as site evaluation, damage reports, and law enforcement. If more than one incidence of looting archeological or paleontological sites every three years occurs, then other possible strategies include increased education, monitoring, and patrols. The management team would also consider installing electronic monitoring systems in problem areas.

TABLE 3. WILDERNESS MONITORING FRAMEWORK

Indicator	Measure	Potential Standards	Management Strategies
Untrammeled Quality			
Actions authorized by the federal land manager that manipulate the biophysical environment	Number of projects per year to treat invasive plant species.	No more than three restoration projects per year per 20 acres of wilderness.	Increased education of project team members to reduce impact resulting from restoration work. Increased partnerships with neighboring landowners to exclude introduction of new invasive species into the wilderness.
Actions authorized by the federal land manager that manipulate the biophysical environment and loss of statutorily protected cultural resources (undeveloped quality indicator)	Number of square feet of disturbed area due to paleontological and archeological activities.	No more than 400 square feet of disturbed area per year.	Educate researchers about ways to reduce impact in wilderness. Implement additional mitigation measures (i.e., re-vegetation and re-contouring of disturbed site).
Actions not authorized by the federal land manager that manipulate the biophysical environment	Number of incidences per year of livestock or ATVs (or their evidence) observed in the wilderness.	No more than one incidence per year. If more than 10 incidences in the wilderness per year, move down the list of more stringent management strategies.	Any sighting of livestock or ATVs in the wilderness triggers management action (i.e., fence repair, law enforcement). Increased education of neighbors. Increased monitoring and repair of fence conditions to prevent trespass. Increased wilderness patrols.

TABLE 3. WILDERNESS MONITORING FRAMEWORK

Indicator	Measure	Potential Standards	Management Strategies
Natural Quality			
Plant and animal species and communities	Changes in abundance and distribution of invasive species (e.g., tamarisk).	No more than 5% increase in range of existing invasive species (species density per acre).	Increase education of wilderness visitors (i.e., weed-free feed for pack animals). Use citizen scientists to assist with identifying the location of invasive species for future eradication. Perform invasive species control and removal measures and consider revegetation. Treat invasive species more aggressively in the backcountry.
Physical resources	Visibility based on average deciview and sum of anthropogenic fine nitrate and sulfate.	National standards would apply. http://vista.cira.colostate.edu/IMPROVE/	Educate public about sources that reduce visibility. Evaluate and reduce the park's contribution to air pollution. Work with NPS Air Quality Division on air quality improvement strategies.
	Ozone air pollution based on primary and secondary Environmental Protection Agency (EPA) standards.	National Standards would apply. http://www.epa.gov/air/criteria.html	Educate public about sources that reduce visibility. Evaluate and reduce the park's contribution to air pollution. Work with NPS Air Quality Division on air quality improvement strategies.

TABLE 3. WILDERNESS MONITORING FRAMEWORK

Indicator	Measure	Potential Standards	Management Strategies
Biophysical processes	Determine changes in the plant species composition (as related to climate change) in the wilderness area in collaboration with external partners (I&M and NOAA).	If trends in loss of indicator plant species currently found in the wilderness occur, or if the changing ranges of native species occur, then management strategies will be initiated.	Educate public about sources of climate change and its effects on wilderness resources. Evaluate and reduce the park's contribution to climate change. Work with partners to monitor and reduce the effects of climate change on wilderness resources.
Undeveloped Quality			
Nonrecreational structures, installations, and developments	Number of developments found in the wilderness. Currently none exist.	If a proposal for development in wilderness occurs, management strategies will be discussed. The ideal standard for the park is no developments in wilderness.	If options for development are considered, seek alternative management strategies (i.e., increase education on wilderness etiquette and encourage more dispersed use, etc.).
Use of motor vehicles, motorized equipment, or mechanical transport	Number of occurrences of administrative and nonemergency use of motorized equipment or mechanical transport (e.g., boundary fence maintenance, collection and removal of paleontological and archeological specimens).	No more than three occurrences per year with approved minimum requirements review per wilderness unit.	Conduct annual planning to determine what uses will or will not occur. Implement minimum requirements review process to ensure appropriate approvals. Ensure that all occurrences result in no net long-term decrease to wilderness character. Provide staff training for use of nonmechanized tools.

TABLE 3. WILDERNESS MONITORING FRAMEWORK

Indicator	Measure	Potential Standards	Management Strategies
Solitude or Primitive and Unconfined Recreation			
Remoteness from sights and sounds of people inside the wilderness	Number of visitor responses in trail register annually (after installation of new register in near north unit). Number of overnight camping permits issued annually.	A five-year increase in trail register numbers would trigger management actions.	Increase patrols to monitor wilderness distribution (including number of people and location). Verify the numbers with on-site counts Implement a detailed visitor survey to better understand visitor perceptions and use patterns. Consider doing an exit survey.
	Evidence of human disturbance in wilderness. Rapid site inventory assessment as listed in 2006 Foti report (this combines a variety of measures to come up with an overall ranking).	Using Foti (2006) report as a baseline: 90% of sites will fall into the unimpacted or slightly impacted categories.	Better education of people entering wilderness. Increase monitoring and patrols. Use clean-up crews in wilderness. Encourage dispersed use by redirecting use to other areas of the wilderness.
Remoteness from occupied and modified areas outside the wilderness	Light pollution as measured with established methods from night sky program / inventory and monitoring program.	Increase in measured light pollution of ≤ 10% above baseline.	Work actively within the park for compliant dark night sky lighting. Create an educational campaign and communicate the issue of light pollution through publications. Proactively work with local industry and neighbors to promote dark night skies and encourage compliant technology.

TABLE 3. WILDERNESS MONITORING FRAMEWORK

Indicator	Measure	Potential Standards	Management Strategies
Remoteness from occupied and modified areas outside the wilderness	Percent time audibility of extrinsic noise.	The hourly percent time audible of human-caused noise would be ≤ 10% for 90% of the day. Additionally, the hourly percent time audible should never exceed 30%.	Add information about soundscapes to wilderness education materials. Encourage visitors to appreciate the natural sound environment. Encourage visitors to limit the use of artificial sounds (cell phones, etc.) in wilderness. Encourage visitors to turn off car alarms.
	Viewshed intrusions as measured with established viewshed analysis procedures.	Management strategies will be initiated upon approval of this plan.	Create an educational campaign and communicate the issue of viewshed intrusions into wilderness. Proactively work with neighbors and local industry to encourage wilderness-friendly viewshed projects.
Facilities that decrease self-reliant recreation (there are none)	Type and number of agency-provided recreation facilities.	No new installations in wilderness without MRDG approval.	Increase management enforcement and accountability.
Management restrictions on visitor behavior	Type and number of management restrictions.	No new restrictions on visitor use without careful consideration of impacts to wilderness character.	Establish a park wilderness advisory committee. Consider using MRDG process for proposed restrictions.

TABLE 3. WILDERNESS MONITORING FRAMEWORK

Indicator	Measure	Potential Standards	Management Strategies
Other Features and Values			
Deterioration or loss of cultural resources and paleontological resources.	Number of instances of illegal or unauthorized collection / damage to archeological or paleontological resources (also untrammeled quality measure).	No incidences of collection/damage would be acceptable each year.	Any instance of collection or damage triggers management action (i.e., site evaluation, damage report, law enforcement).
		No incidences of collection/damage would be acceptable each year. However, more than one incidence of looting archeological or paleontological sites every three years would trigger a higher intensity of management strategies.	Any incident of looting would trigger an increase in visitor education, monitoring, and patrol. Consider installing electronic monitoring systems at problem areas. If these management actions are not effective, more stringent efforts to enforce regulations and protect resources would be considered.

MITIGATIVE MEASURES

Congress charged the National Park Service with managing the lands under its stewardship "in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (NPS Organic Act, 16 USC 1). As a result, NPS staff routinely evaluate and implement mitigative measures whenever conditions occur that could adversely affect the sustainability of national park system resources.

Mitigative measures are the practicable and appropriate methods that would be used under the action alternative to avoid and/or minimize harm to wilderness natural and cultural resources, wilderness character qualities, visitors, and the visitor experience.

The wilderness stewardship plan provides a management framework for the wilderness area. Within this broad context, the following mitigative measures would be used to avoid or minimize potential impacts from implementation of the action alternative. These measures would be applied, subject to funding and staffing constraints. Additional mitigation would be identified as part of implementation planning and for individual projects to further minimize impacts.

NATURAL RESOURCES

New facilities (access points, trails, and administrative access roads) would be sited in disturbed areas whenever feasible to avoid causing new impacts to resources. Boardwalks, fences, signs, and similar measures would be used to route people off of or away from sensitive resources such as petrified wood and other fossils, while still permitting access.

Construction zones would be identified prior to any construction activity. This would define the construction zone and confine activity to the minimum area required. All protection measures would be clearly stated in construction specifications and workers would be instructed to avoid areas beyond the fencing.

Measures to control dust and erosion during construction would be implemented and could include the following: watering dry soils; using silt fences and sedimentation basins; stabilizing soils during and after construction with specially designed fabrics, certified straw, or other materials; covering haul trucks; employing speed limits on unpaved roads; and revegetating disturbed areas with native species as soon as possible after construction.

Standard noise abatement measures would be implemented during park operations and construction activities. These measures could include the following: scheduling activities so that impacts are minimized, use of the best available noise control techniques, use of hydraulically or electrically powered tools, and situating noise-producing machinery as far as possible from sensitive uses or resources.

SOILS

Best management practices to prevent soil erosion would be used, such as the use of silt fences during the development of additional access points and the trail through the backcountry to the wilderness boundary. These techniques would mitigate potential impacts on the biological soil crusts, Lithodendron Wash, and any other adjacent water resources.

PALEONTOLOGICAL RESOURCES

Best management practices would be used during the collection of exposed fossils to ensure that they are not damaged during excavation. Also, see the minimum requirements decision guidelines for other mitigative measures associated with excavation of paleontological resources in the wilderness areas.

Park staff would design the trail through the backcountry area for wilderness access and the additional access points away from fossil-rich areas, which would help minimize these impacts. As part of this approach, paleontological inventories would be necessary before appropriate public access points and routes are determined.

VEGETATION AND WILDLIFE

Special attention would be devoted to preventing the spread of invasive plant species. Standard operating procedures could include ensuring that park vehicles entering the administrative access areas are free of mud or other seed-bearing material and using appropriate native plant species during restoration work. Also, see minimum requirements decision guidelines for other mitigative measures to minimize impacts associated with livestock trespass and visitor use.

Federal and State Listed Species

There are no sited and documented federal or state listed species within the wilderness area. However, if any federal or state listed threatened and endangered species or species of concern are sited and documented in the future, appropriate mitigation actions would occur prior to construction to minimize immediate and long-term impacts to rare, threatened, and endangered species. Surveys would be conducted for such species as warranted. Facilities (access points, trails, and administrative access roads) would be sited and designed so as to avoid adverse effects on rare, threatened, and endangered species whenever possible. If avoidance is infeasible, adverse effects would be minimized and compensated for, as appropriate, and in consultation with appropriate resource agencies. Measures would be taken to reduce the adverse effects of invasive species on special status species. These measures would be applied to mitigate impacts to pronghorn populations and habitat.

CULTURAL RESOURCES

The National Park Service would preserve and protect, to the greatest extent possible, cultural resources that reflect human occupation of Petrified Forest National Park and its wilderness area. Specific mitigating measures include the following:

- NPS staff would continue to conduct surveys and other research necessary to effectively document and manage archeological, historic, and ethnographic resources in wilderness. Survey and research activities would be conducted in a fashion consistent with the protection of wilderness values. Identified sites would be evaluated for their eligibility for listing in the National Register of Historic Places. Appropriate resource treatments and research would be carried out in accordance with the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation*. As needed, the results of these efforts would be incorporated into site-specific planning and environmental analysis documents.

- Known archeological resources would be routinely monitored to assess and document site conditions and the effects on resources resulting from natural erosional processes and human activities. Archeological

resources would be left undisturbed and preserved in a stable condition to prevent degradation and loss of research values unless intervention could be justified based on compelling research or site protection needs. Recovered archeological materials and associated records would be treated in accordance with NPS *Management Policies 2006*, NPS *Museum Handbook*, and 36 CFR Part 79.

- In accordance with section 106 of the National Historic Preservation Act, archeological surveys and investigations would precede any construction- or project-related ground disturbance (e.g., the development of access trails in the backcountry, paleontological research excavations) to ensure that significant archeological resources are avoided to the greatest extent possible. If previously unknown resources are discovered, all work in the immediate vicinity of the discovery would cease until the resources are assessed and documented. An appropriate mitigation strategy would be developed in consultation with the Arizona SHPO and associated American Indian tribes if resources could not be avoided.

- In the event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered, provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) would be followed. If non-Indian human remains were discovered, standard reporting procedures to notify the proper authorities would be followed, as would all applicable federal, state, and local laws.

- NPS staff would continue ongoing consultations with traditionally associated American Indian tribes. Sensitive, sacred, or traditional use areas would be protected to the greatest extent possible by avoiding or mitigating adverse impacts to ethnographic resources, retaining site confidentiality as appropriate, and continuing to provide tribal access to resources and places of cultural importance.

- NPS staff would continue to inform visitors of the importance of respecting and not disturbing archeological or ethnographic resources in wilderness or other areas of the park. Visitors would be informed (through NPS educational and interpretive programs and ranger contacts) of the penalties for illegally collecting artifacts, defacing petroglyphs, or otherwise causing resource damage. Visitors would also be encouraged not to disturb offerings that are customarily placed by culturally associated tribal members at various places in the park.

VISITOR USE AND EXPERIENCE

The National Park Service would provide for meaningful visitor experiences and access while ensuring that public safety measures are in place at all times. Specific mitigating measures include the following:

- Minimum Requirement Decision Guides would continue to be used to mitigate impacts to visitor experience of solitude and primitive and unconfined types of recreation, especially for fence maintenance, cultural and ethnographic resource inventories and repairs, and activities related to scientific research.

- General minimum requirements guidance would also be applied to mitigate possible impacts from

wilderness monitoring activities on visitor experience of solitude and primitive and unconfined types of recreation.

- Visitor safety concerns would continue to be integrated into NPS educational programs and outreach materials. Directional signs and trails would be used in the backcountry zone leading to wilderness to orient visitors, and education programs would continue to promote understanding among visitors.

- The park shall develop a communications strategy to alert visitors to pertinent elements of the trail construction schedule and fire management schedule.

- Measures to reduce adverse effects of trail construction on visitor safety and experience would be implemented, including scheduling the use of equipment during nonpeak visitation times. A construction work schedule shall be prepared by the trail crew to minimize the effects on visitors. This work schedule shall be submitted for park review and approval prior to construction.

- Trail construction equipment and materials will be stored with consideration to the scenic values and the sense of place that visitors associate with the wilderness landscape. To mitigate impacts to the visitor experience, construction equipment and materials will be consolidated in staging areas at the end of each work day to limit the visual intrusion of construction equipment during nonwork hours.

- Outdoor lighting for new or rehabilitated facilities would be the minimum amount required to provide for visitor safety. Lights would also be shielded and/or directed downward to minimize impacts on visitor experience of the dark night sky while camping in wilderness.

- Standard noise abatement measures would be implemented, as appropriate, during park operations and construction activities to reduce impacts to visitor opportunities for solitude and primitive and unconfined types of recreation.

- The park staff would continue to collect and use visitation data, communication with landowners, and other information to identify user conflicts and landowner concerns related to public use. Actions would then be implemented to reduce or eliminate conflicts according to the Wilderness Stewardship Plan.

FUTURE STUDIES AND IMPLEMENTATION PLANS

After the completion and approval of this Wilderness Stewardship Plan, other more detailed studies and plans will be needed to fully implement this plan. As required, additional environmental compliance (National Environmental Policy Act, National Historic Preservation Act, and other relevant laws and policies) and public involvement would be conducted. Implementation of these studies and plans would also depend on future funding and staffing levels. The approval of this wilderness stewardship plan does not guarantee that the funding needed for these studies and plans would be forthcoming. These additional plans and studies include the following:

STUDIES AND INVENTORIES

- surveys of flora and fauna to determine habitat use and distribution
- inventory of nonnative species
- inventory of paleontological sites
- inventory of special status species
- inventory of air quality
- inventory of soundscapes
- inventory of night skies
- survey of archeological sites, historic sites, and other cultural resources
- study day use to collect more information
- study effects of climate change, including identifying key resources and processes that are at risk from climate change, and establishing resource conditions and thresholds for change
- wilderness study for recently acquired lands within the expanded boundary of the park

IMPLEMENTATION PLANS

- vegetation management plan
- complete the parkwide fire management plan, which includes the wilderness area

STAFFING AND COST ESTIMATES

National Park Service decision makers and the public must consider an overall picture of the costs and advantages of various alternatives, including the no-action alternative, to make wise planning and management decisions for the park wilderness area. Such consideration can shed light on the cost of the no-action alternative and make possible a more relevant comparison to the action alternative.

The figures presented in table 4 are estimates for comparison purposes only and are not to be used for budgetary purposes or implementation funding requests. If and when the actions are implemented, actual costs may vary.

Presentation of costs in this plan does not guarantee future NPS funding. Project funding would not come all at once and it may take years to secure. Although the park hopes to secure this funding and will prepare itself accordingly, the park may not receive enough funding to achieve all desired conditions within the timeframe of the wilderness stewardship plan (the next 20 years).

The estimates provided in this section include staffing levels, annual operating costs, one-time facility costs, and one-time nonfacility costs. A definition of each of these types of costs follows:

- ***Staffing*** is the total number of person-years of staff required to manage the wilderness area at an acceptable level, provide visitor services, and protect resources. The full-time equivalency (FTE) number indicates NPS staffing levels, not volunteer positions or positions funded by partners. Full-time equivalency salaries and benefits are included in the annual operating costs.

- ***Annual Operating Costs*** are the total costs per year for maintenance and operations associated with each alternative, including monitoring equipment and supplies, staff salaries and benefits, and other materials. Cost and staffing estimates assume that the alternative is fully implemented as described.

- ***One-time Nonfacility Costs*** include the development of interpretive media that would require initial funding above annual operating costs.

- ***One-time Facility Costs*** include those for the design, construction, rehabilitation, and improvements of wilderness access points (e.g., trailheads, parking areas, interpretive waysides, and backcountry trails (leading up to the north wilderness boundary).

Staffing and annual operating cost estimates for the action alternative are calculated by taking the staffing and annual operating costs under the no-action alternative and adding any additional costs associated with the proposed actions. Table 4 provides staffing and cost estimates to fully implement the two alternatives.

TABLE 4. STAFFING AND COST ESTIMATES FOR FULL IMPLEMENTATION OF THE ALTERNATIVES

	Alternative A No Action	Alternative B NPS Preferred Alternative
Staffing Levels (FTEs)	3.0	3.0
Annual Operating Costs	$215,000	$235,000
One-Time Nonfacility Costs	$0	$20,000
One-Time Facility Costs	$0	$50,000

Staffing Levels

There are no staffing level differences between the two alternatives. The three existing FTEs presented in table 4 are a portion of the total park staff needed to manage the wilderness area. It includes 1.5 FTEs from the law enforcement division, 0.5 FTE from the maintenance division, 0.5 FTE from the interpretation division, and 0.5 FTE from the resource management division.

Although alternative B proposes a more comprehensive approach to wilderness management, it does not require additional staffing to implement these new management strategies. It is not about doing substantially more; it is about doing it differently—in a more proactive way that is in accordance with the requirements of the Wilderness Act.

Annual Operating Costs

The majority of the annual operating costs presented in table 4 above are to cover salary and benefits for three FTEs. The remaining amount is needed to cover equipment and supplies for monitoring and maintenance activities. The annual operating costs associated with alternative B are slightly higher than alternative A due to the comprehensive nature of the proposed monitoring framework.

One-time Nonfacility Costs

Under alternative B, the one-time nonfacility costs are associated with developing new interpretive media for the wilderness area, including waysides at select sites, brochures, and podcasts.

One-time Facility Costs

Under alternative B, the one-time facility costs are associated with designating trails through the backcountry zone to access the north wilderness unit (via Kachina and Tiponi points) and to designate a public access point to Devil's Playground.

THE ENVIRONMENTALLY PREFERABLE ALTERNATIVE

According to Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (43 CFR 46.30), the environmentally preferable alternative is the alternative "that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the responsible official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative."

Alternative B provides proactive, comprehensive management of the two park wilderness units, and is identified as the environmentally preferable alternative for the following reasons:

- The alternative provides for enhanced protection and management of wildlife, vegetation, and special status species in wilderness areas by proposing investigations and strategies (e.g., vegetation management planning, nonnative species inventories, wildlife management protocols) that better document habitat use, species distribution, and support other natural resource management objectives.
- The development of protocols for paleontological research and monitoring within wilderness (including the application of a programmatic MRDG) would better ensure that fragile paleontological resources are protected, that excavated specimens are recovered in a timely manner, and that research activities result in minimal environmental disturbance.
- The alternative provides for continuing cultural resource surveys and investigations in wilderness units, while further ensuring that cultural resource management is conducted in a manner that protects wilderness character. Increased emphasis would be placed on cultural resources monitoring in accordance with the comprehensive wilderness monitoring framework, and park staff would adhere to the MRDG for conducting research and data recovery.
- Implementation of a comprehensive monitoring strategy as part of the wilderness stewardship framework would enhance the ability of the park staff to track trends and assess progress toward attaining desired conditions for the preservation of wilderness character.
- The emphasis on expanding and improving partnerships with park neighbors, stakeholders and volunteers would improve the ability of the park staff to carry out comprehensive resource protection (e.g., management of invasive species, archeological and paleontological research and monitoring, coordinating responses to external resource threats).
- The comprehensive resource protection objectives are supported by expanded efforts to educate and inform park visitors and park personnel of the importance, methods, and protocols of resource protection in wilderness and other areas of the park.
- Traditionally associated American Indian tribes would continue to be

provided appropriate access to sacred sites and culturally important resources in wilderness. Information received by the park during ongoing tribal consultations would be incorporated, as appropriate, to assist resource management.

- Improved resource protection would be expected from limitations on the size of overnight camping groups, other camping restrictions, limits on horse use, implementation of human waste management measures, formalizing visitor access into the north wilderness unit, and other measures to minimize impacts associated with visitor use.
- Park operational activities (e.g., maintenance of wilderness area boundary fencing, selection of optional access points into wilderness units for research and monitoring) would be conducted that best protects resources and wilderness character and, as appropriate, that is in accordance with MRDG protocols.

For the reasons presented above, alternative B causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources, thereby making it the environmentally preferable alternative.
In comparison, the continuation of current management actions under alternative A was determined not to provide a comprehensive strategy for resource protection in a manner that fully considers preservation of wilderness character and values. Although resource management would proceed under existing laws and policies, ongoing research, operations, and visitor use activities would be expected to continue without the benefit of coordinated monitoring strategies, protocols, or MRDGs to ensure resource protection and preservation of wilderness character. The ability of the park staff to effectively manage the wilderness units under provisions of the outdated backcountry management plan (1979) would continue to be limited, and without the benefits and assistance provided by enhanced partnerships with stakeholders and improved educational outreach.

No new information came from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Alternative B is the environmentally preferable alternative and better meets project objectives; therefore, it is also considered the NPS preferred alternative. For the remainder of the document, alternative B will be referred to as the preferred alternative.

TABLE 5. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Management Topic	Alternative A (No Action)	Alternative B (NPS Preferred)
Wildlife Management	▪ Minimal wildlife management occurs in the wilderness. Continue standard protocols for inventorying and monitoring in wilderness. Modify protocols on a case-by-case basis to protect wilderness values.	▪ Survey fauna within wilderness to determine habitat use and distribution (may be applied to climate change studies). ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as any changes in abundance and distribution of invasive wildlife species) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Vegetation Management	▪ Baseline vegetation surveys are complete. ▪ Inventory nonnative species in wilderness.	▪ Survey flora within wilderness to determine habitat use and distribution (may be applied to climate change studies). ▪ Develop vegetation management plan for park, including wilderness. ▪ Inventory for nonnative species in wilderness. ▪ Work with neighboring property owners to manage invasive plants (tamarisk). ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as any changes in abundance and distribution of invasive plant species) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Paleontological Resources (including scientific research)	▪ Prospect, collect, and curate paleontological objects from wilderness area, also with partners. ▪ Inventory, monitor, and document conditions of paleontological sites in wilderness.	▪ Establish protocols for paleontological research and monitoring within wilderness, also with partners. ▪ Inventory, monitor, and document conditions of paleontological sites in wilderness. Consider using volunteers and education groups to assist. ▪ Adhere to a programmatic minimum requirements decision guide for conducting research within wilderness. ▪ Designate appropriate administrative access points into the wilderness. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.

TABLE 5. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Management Topic	Alternative A (No Action)	Alternative B (NPS Preferred)
Threatened and Endangered Species	▪ Continue to inventory and monitor for their presence.	▪ Continue to inventory and monitor for their presence. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as any changes in abundance and distribution of invasive wildlife species) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Fire Management	▪ The National Park Service is in the process of completing a fire management plan for the park, which includes the designated wilderness area. The plan states that fire management activities would be designed to protect wilderness values.	▪ The National Park Service is in the process of completing a fire management plan for the park, which includes the designated wilderness area. The plan states that fire management activities would be designed to protect wilderness values.
Air and Water Quality	▪ Continue collecting data on air quality. Water quality data is not collected due to its scarcity.	▪ Continue collecting data on air quality. Water quality data is not collected due to its scarcity. ▪ Educate staff and visitors about park air quality and trends and class I air quality requirements. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as increases in anthropogenic fine nitrate and sulfate and level of ozone air pollution) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Soundscapes and Night Skies	▪ Continue collecting data on soundscapes and night skies.	▪ Continue collecting data on soundscapes and night skies. ▪ Educate staff and visitors about traveling quietly and minimizing the use of artificial portable lighting in the wilderness. ▪ Showcase the dark night skies of the wilderness area to educate partners about the beneficial effects of reducing light pollution. Become a better example through stewardship. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as the audibility of extrinsic noise, viewshed intrusions, and light pollution) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.

TABLE 5. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Management Topic	Alternative A (No Action)	Alternative B (NPS Preferred)
Archeological Resource Management	▪ Existing parkwide inventory, monitoring and other management/protection requirements for archeological resources would continue in accordance with all applicable laws and policies. ▪ Prehistoric sites have been recorded in both wilderness units although a larger portion of the south wilderness has been surveyed for archeological resources. Archeological surveys would continue to be carried out on previously unsurveyed portions of both units as funding permits. ▪ The park would continue to consult with associated tribes to inform cultural resources management.	▪ Existing parkwide inventory, monitoring, and other management/protection requirements for archeological resources would continue in accordance with all applicable laws and policies. ▪ Determine appropriate guidelines for testing, monitoring, and managing archeological resources in wilderness in a manner that protects wilderness character. ▪ Enhance visitor education and outreach to better inform visitors of archeological resource protection objectives. ▪ Continue to survey and document the north and south wilderness units for archeological and historic sites. ▪ Adhere to a programmatic minimum requirements decision guide for conducting archeological research and data recovery within wilderness. ▪ Consult with associated tribes to inform cultural resources management. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as disturbance from archeological activities) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Ethnographic Resource Management	▪ Park would continue to identify, monitor and protect/manage ethnographic resources throughout the park in accordance with applicable laws and policies and in consultation with associated tribes (Hopi Tribe, Pueblo of Zuni, and the Navajo Nation). ▪ Tribal access would continue to be maintained to ethnographic resources and sacred sites throughout the park including wilderness units.	▪ Park would continue to identify, monitor, and protect/manage ethnographic resources throughout the park in accordance with applicable laws and policies and in consultation with associated tribes (Hopi Tribe, Pueblo of Zuni, and the Navajo Nation). ▪ Tribal access would continue to be maintained to ethnographic resources and sacred sites throughout the park including wilderness units. ▪ Enhance visitor education and outreach to better inform visitors of ethnographic resource protection objectives. ▪ Park would enhance partnerships with associated tribes and park neighbors to mutually support ethnographic resource protection.
Visitor Use and Experience: Opportunities for Solitude and Primitive / Unconfined Recreation	▪ Continue policy of no trails and signs, and use camping zones to encourage dispersed use throughout the wilderness area.	▪ Continue policy of no trails and signs, and use camping zones to encourage dispersed use throughout the wilderness area. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (number of visitors and overnight camping permits, evidence of human disturbance, light pollution, level of extrinsic noise, and viewshed intrusions) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.

TABLE 5. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Management Topic	Alternative A (No Action)	Alternative B (NPS Preferred)
Visitor Use and Experience: Access	▪ Continue to allow undesignated, cross-country travel across the backcountry for visitor access to the wilderness.	▪ Construct one trail for visitor use in the backcountry in order to provide more formalized access into the north wilderness unit. ▪ Additional public access points into the north wilderness from Tiponi Point and Devil's Playground may be established for future use. ▪ Standardize and implement wilderness access points/policies. ▪ Educate staff regarding south wilderness access points to inform visitors seeking opportunities there. ▪ Monitor the effects of additional formal wilderness access points on select wilderness values. ▪ Create trail register and IR counter for access points into north wilderness unit to collect more detailed information about day use visitation. ▪ Minimize the use of trails and signs (trails, virtual trails, signs, waste management containers, campsites, and permits).
Visitor Use and Experience: Camping (also see "Visitor Use & Experience: Wilderness Regulations" for camping regulations)	▪ Continue to allow dispersed camping only in designated wilderness.	▪ Allow dispersed camping in the backcountry during times when Lithodendron Wash is impassible, during inclement weather, or other circumstances deemed necessary by park management. A new zone (zone 5) will be designated for backcountry camping. ▪ Delineate existing camping zones on a map in the plan that is used for issuing camping permits. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as the number of overnight camping permits and regulations implemented) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Visitor Use & Experience: Interpretation and Education	▪ A trailhead wayside is provided at Kachina Point for visitors accessing the north wilderness unit. ▪ Wilderness information is provided to visitors requesting overnight permits. ▪ A wilderness page is provided on the park website and in the park newspaper.	▪ Develop media for communicating wilderness values, safety, and appropriate uses to the public. Media could include displays, waysides, books, brochures, videos, and web pages. ▪ Offer students education about wilderness etiquette and how to conduct research and studies in wilderness. ▪ Enhance interpretive programs and opportunities for wilderness visitors (e.g., ranger walks).

TABLE 5. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Management Topic	Alternative A (No Action)	Alternative B (NPS Preferred)
Visitor Use and Experience: Wilderness Regulations	▪ Permits required for overnight camping. Limitations on total number of nights in one place (14 nights). ▪ Group size limitation for overnight camping (8). ▪ Limitations on number of horses. ▪ Pets (dogs only) are allowed (leashed). ▪ No open campfires. ▪ Cannot leave wilderness and return to frontcountry of park at night. ▪ Wilderness units are divided into four camping zones. ▪ 50 total campers per night at north wilderness; 25 in south wilderness. ▪ Camping is restricted to wilderness only.	▪ Permits required for overnight camping. Limitations on total number of nights in one place (14 nights). ▪ Group size limitation for overnight camping (8). ▪ Limitations on number of horses. ▪ Pets (dogs only) are allowed (leashed). ▪ No open campfires. ▪ Cannot leave wilderness and return to frontcountry of park at night. ▪ 50 total campers per night at north wilderness; 25 in south wilderness. ▪ Pack animal use would be based on Superintendent's Compendium. ▪ Dispersed camping in backcountry area (zone 5) would be allowed. ▪ Human waste management strategy. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as the type and number of overall management restrictions) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.

TABLE 5. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Management Topic	Alternative A (No Action)	Alternative B (NPS Preferred)
Park Operations: General	▪ Current management continued (as described in the subcategories below).	▪ Significantly improve training for park staff, especially front-line staff, regarding park wilderness, regulations, resources, and opportunities for visitors in the wilderness, resulting in improved visitor education. ▪ Develop and provide the continuity of an in-house interdivisional education program for as many staff as possible on wilderness values (incorporate into training). ▪ Train personnel or complete programs on horse use within the wilderness for monitoring or fence repairs. ▪ Schedule periodic wilderness area foot and horse patrols to monitor evidence of use. ▪ Recruit volunteers to help with multiple aspects of wilderness management. ▪ Assist with training staff in issuing backcountry permits. ▪ Optional administrative access points into the wilderness units would be considered for research and monitoring to prevent the establishment of well-defined administrative trails in the wilderness (i.e., ease of access, efficiency in work, minimize impacts on wilderness qualities, such as solitude, trammeling, etc.). ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as the number of invasive plant treatment projects, disturbance from paleontological activities, and nonemergency administrative use of motorized equipment or mechanical transport) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Park Operations: Emergency Response	▪ Continue emergency response on horseback or by foot to carry out injured visitors from the wilderness. Emergency response would be consistent with the emergency response plan of the park.	▪ Continue emergency response on horseback or by foot to carry out injured visitors from the wilderness. Emergency response would be consistent with the emergency response plan of the park, utilizing partnering agencies as appropriate.
Park Operations: Boundary Fence	▪ Continue to repair and maintain boundary fence and associated access roads as needed.	▪ Develop a programmatic minimum requirements analysis for maintaining the boundary fence. ▪ Establish a schedule for monitoring fence and access route to determine when maintenance is necessary. ▪ Manage fences via partnerships with neighbors. ▪ Wildlife-friendly boundary fence.

TABLE 5. SUMMARY OF KEY DIFFERENCES AMONG THE ALTERNATIVES

Management Topic	Alternative A (No Action)	Alternative B (NPS Preferred)
Park Operations: Scientific Research	▪ Authorize and coordinate research activities in the wilderness on a case by case basis.	▪ Develop a programmatic minimum requirements analysis for conducting research within wilderness. ▪ Coordinate park staff to document sensitive areas in wilderness and monitor sites. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as disturbance associated with paleontological and archeological activities) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Park Operations: Sanitation/ Waste Management	▪ No current policy or education provided.	▪ Establish a policy for disposal of human waste in the wilderness and educate visitors. ▪ The proactive implementation of the monitoring framework would track conditions of these particular types of resources (such as evidence of human disturbance) and if conditions exceed a standard, then specific management strategies would be implemented to protect the wilderness qualities associated with wilderness management.
Partnerships/ Outreach	▪ Partnerships and public outreach efforts about the value of park wilderness units are and would continue to be minimal.	▪ Encourage visitors to engage in wilderness management and education, and ask visitors to report their observations (volunteer basis). ▪ Take advantage of internship programs and cooperative agreements that offer students wilderness management experiences that assist the park. ▪ Work with neighboring properties to manage invasive plants (tamarisk) including the Navajo Nation near the north unit. ▪ Manage fences via partnerships with neighbors. ▪ Build partnerships with neighbors to help protect wilderness values along the edge of the wilderness. ▪ Increase public profile of park wilderness through expanded community outreach (including popular media). ▪ Utilize partnerships and potential friends groups to conduct scientific research in wilderness.

TABLE 6. SUMMARY OF KEY IMPACTS ALTERNATIVES

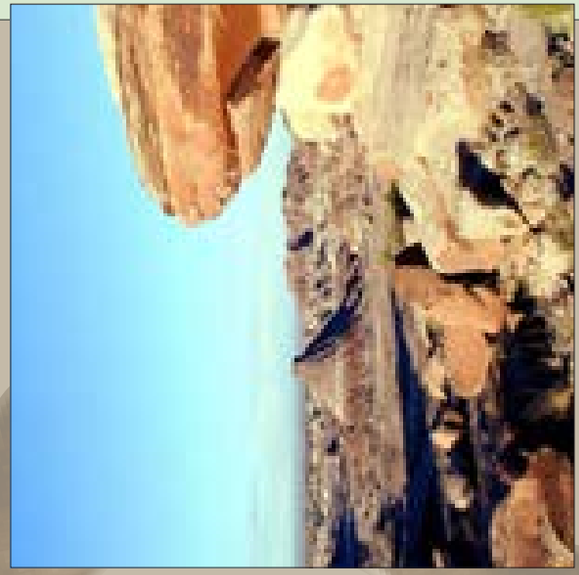
Impact Topic	No-action Alternative	Action Alternative
Geological Resources and Soils	The no-action alternative would result in long-term, minor to moderate, adverse impacts and long-term, negligible to minor, beneficial impacts on geologic resources and soils in the wilderness area. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. This alternative's contribution to these effects would be slight.	The action alternative would result in long-term, minor to moderate, adverse as well as negligible to minor, long-term, beneficial impacts on geologic resources and soils in the park wilderness area. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. This alternative's contributions to these effects would be slight.
Paleontological Resources, including Petrified Wood	The no-action alternative would result in long-term, minor to moderate, adverse impacts and long-term, negligible to minor, beneficial impacts on paleontological resources in the wilderness area. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. This alternative's contribution to these effects would be slight.	The action alternative would result in long-term, minor to moderate, beneficial impacts on paleontological resources in the park wilderness area. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor, adverse and long-term, minor to moderate, beneficial cumulative effects. This alternative's contributions to these effects would be slight.
Vegetation and Wildlife	The no-action alternative would result in long-term, minor to moderate, adverse impacts as well as long-term, negligible to minor, beneficial impacts on vegetation and wildlife in the wilderness area. When combined with other past and foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. This alternative's contribution to these effects would be slight.	The action alternative would result in long- and short-term, negligible to minor, adverse impacts as well as long-term, minor to moderate, beneficial impacts on vegetation and wildlife in the wilderness area. When combined with other past and foreseeable actions, this alternative would have long- and short-term, negligible to minor, adverse and long-term, minor to moderate, beneficial cumulative effects. This alternative's contribution to these effects would be slight.
Archeological Resources	Long-term or permanent, localized, negligible to minor, adverse impacts on park prehistoric and historic archeological resources in wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from the continued management of archeological resources in accordance with NPS policies and guidelines. Long-term or permanent, minor to moderate, adverse, cumulative impacts on archeological resources would result from implementation of alternative A.	Long-term or permanent, localized, negligible to minor, adverse impacts on park prehistoric and historic archeological resources in wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from continued management of archeological resources in accordance with NPS policies and guidelines, adoption of "minimum requirements decision guide" protocols, and enhanced public outreach and partnerships. Long-term or permanent, minor to moderate, adverse cumulative impacts on archeological resources would result from implementation of alternative B.

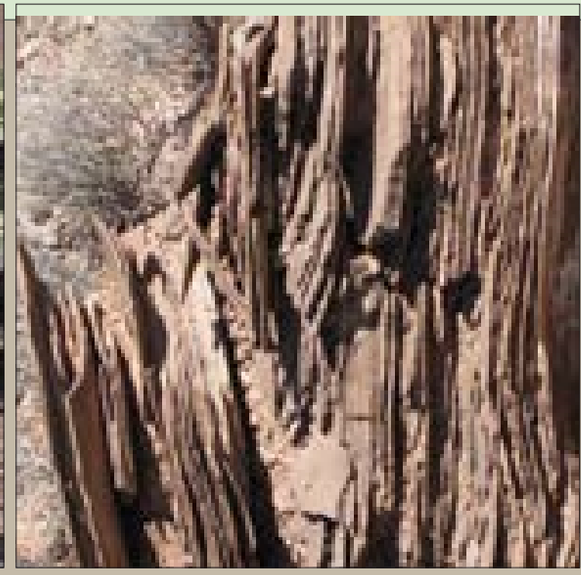
TABLE 6. SUMMARY OF KEY IMPACTS ALTERNATIVES

Impact Topic	No-action Alternative	Action Alternative
Ethnographic Resources	Long-term or permanent, localized, negligible to minor, adverse impacts on park ethnographic resources in wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from management of ethnographic resources in accordance with NPS policies and guidelines. Long-term or permanent, minor to moderate, adverse, cumulative impacts on ethnographic resources would result from implementation of alternative A.	Long-term or permanent, localized, negligible to minor, adverse impacts on park ethnographic resources in wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from management of ethnographic resources in accordance with NPS policies and guidelines, and enhanced public outreach and partnerships. Long-term or permanent, minor to moderate, adverse, cumulative impacts on ethnographic resources would result from implementation of alternative B.
Visitor Use and Experience	Alternative A would result in long-term, negligible, beneficial impacts to visitor experience of viewsheds, dark night skies, solitude and primitive and unconfined types of recreation, and to visitor safety. Alternative A would also result in short-term, negligible, adverse impacts to visitor experience of soundscapes and opportunities for solitude and primitive and unconfined types of recreation. There would be long-term, moderate, adverse impacts to opportunities to understand the wilderness concept, visitors' ability to access the wilderness, and to visitor safety. Overall, there would be long-term, minor to moderate, beneficial impacts to visitor experience when the effects of alternative A are added to the effects of NPS property acquisition. However, there would also be short-term to long-term, moderate, adverse impacts to visitor experience when the impacts of alternative A are added to the effects of external developments and activities occurring outside wilderness and park boundaries.	Compared to alternative A, alternative B provides for a variety of improvements, resulting in mostly beneficial impacts to visitor experience. There would be long-term, negligible to moderate, beneficial impacts to visitor experience of viewsheds, dark night skies, soundscapes, opportunities for primitive and unconfined types of recreation, opportunities to understand the wilderness concept, ability to access the wilderness, and to visitor safety. There would be a small contribution of adverse impacts to visitor experience including short-term, negligible, adverse impacts to visitor experience of soundscapes and opportunities for solitude and primitive and unconfined types of recreation, and possible short-term, moderate, localized, adverse impacts to viewsheds. Overall, there would be long-term, moderate, beneficial impacts to visitor experience when the effects of alternative B are added to the effects of NPS property acquisition. However, there would also be short-term to long-term, negligible to moderate, adverse impacts to visitor experience when the impacts of alternative B are added to the effects of external developments and activities occurring outside wilderness and park boundaries.
Park Operations	The no-action alternative's effect on park operations would continue to be minor and adverse. The cumulative effect on park operations would be long-term, minor, and adverse. The no-action alternative's contribution to this effect would be slight.	The action alternative's effect on park operations would be long-term, moderate, and beneficial and adverse. The cumulative effect on park operations would be long-term, moderate, and adverse; the action alternative's contribution to this effect would be substantial.

TABLE 6. SUMMARY OF KEY IMPACTS ALTERNATIVES

Impact Topic	No-action Alternative	Action Alternative
Socioeconomic Environment	The no-action alternative would have negligible, long-term, beneficial effects on the socioeconomic environment as a result of modest one-time federal spending. When combined with the potential impacts of potash mining, residential and commercial development, and other new sources of economic stimulus, the no-action alternative would have long-term, minor to moderate, beneficial, cumulative impacts on the socioeconomic environment.	Alternative B would have minor, long-term, beneficial effects on the socioeconomic environment as a result of an increase in park spending as well as an increase in visitor spending. When combined with the potential impacts of potash mining, residential and commercial development, and other new sources of economic stimulus, the action alternative would have a long-term, minor to moderate, beneficial, cumulative impact on local and regional economy. The action alternative would contribute a small increment to this cumulative impact.





INTRODUCTION

Chapter 3 describes and characterizes the environment of Petrified Forest National Park with the primary focus on the park wilderness areas. Emphasis is on key natural and cultural resources, visitor use and experience, park operations, and the socioeconomic environment. Wilderness character has also been incorporated within these topic areas, and additional information about the five wilderness qualities is included within the Minimum Requirements Decision Guide (appendix D). The intent of this chapter is not to provide an exhaustive description of resources and other relevant factors, but to provide sufficient detail to reasonably assess and compare the effects of implementing the plan alternatives. Topics were selected on the basis of federal laws, regulations, and executive orders; the contributions of park staff and other NPS subject matter specialists; and the concerns expressed by other agencies, traditionally associated tribes, and members of the public during project scoping. Information provided in the affected environment establishes the baseline conditions for analyzing impacts presented in "Chapter 4: Environmental Consequences."

The interdisciplinary NPS planning team conducted a preliminary analysis to determine the anticipated context, duration, and intensity of effects on resources as a result of implementing plan alternatives. Some topics were dismissed from further analysis if determined not applicable, or if the resource or topic did not occur (or was unlikely to occur) in park wilderness areas or area of effect. Topics were also dismissed if it was determined that the anticipated impacts would have no effect, negligible effect, or possibly a minor effect on resources. Topics carried forward for analysis were determined to result in minor or greater levels of impact intensity.

The first section in this chapter discusses impact topics that are analyzed in detail in this *Wilderness Stewardship Plan / Environmental Assessment*. The next section describes impact topics that are not analyzed in detail and explains the rationale for this decision. Information about each resource topic corresponds to the level and type of impact being analyzed. Because comprehensive resource inventories have not been completed in most instances for the wilderness areas, these descriptions are based on the information that has been gathered to date. Table 7 summarizes impact topics analyzed in this plan and those that have been eliminated from detailed analysis.

In addition, table 7 outlines how wilderness character has been incorporated into the analysis. Because the five qualities of wilderness character overlap with other impact topics, they have been incorporated accordingly. The natural quality of wilderness character has been mostly integrated with the natural resource impact topics. The solitude or a primitive and unconfined type of recreation quality has been incorporated into the visitor use and experience impact topic, and other features and values has been incorporated into the natural resources section (paleontological resources) and the cultural resources sections (archeological resources). Impacts to the untrammeled and undeveloped qualities of wilderness are most directly related to maintenance of the boundary fence and excavation or removal of paleontological resources; therefore, more detailed information regarding these qualities is in the programmatic Minimum Requirements Decision Guides (appendix D).

TABLE 7. IMPACT TOPICS

Impact Topics Analyzed in this Plan	Impact Topics Eliminated from Detailed Analysis in this Plan
NATURAL RESOURCES ▪ Soils ▪ Paleontological Resources (including petrified wood and other fossils) ▪ Vegetation and Wildlife VISITOR USE AND EXPERIENCE CULTURAL RESOURCES ▪ Archeological Resources ▪ Ethnographic Resources PARK OPERATIONS SOCIOECONOMIC ENVIRONMENT WILDERNESS CHARACTER ▪ Natural Quality (see "Natural Resources" section and appendix B) ▪ Solitude or a Primitive and Unconfined Type of Recreation Quality (see "Visitor Use and Experience" section and appendix B) ▪ Other Features and Values Quality (see "Natural Resources" section and appendix B for paleontological resources; see "Cultural Resources" section and appendix B for archeological resources) Undeveloped (see appendix B) ▪ Untrammeled Quality (see appendix B)	Air Quality Carbon Footprint Ecologically Critical Areas Wild and Scenic Rivers Prime or Unique Farmlands Energy Requirements and Conservation Potential Environmental Justice Geologic Resources Geologic Hazards Water Resources (Including water quality, wetlands, floodplains, and streams) Federally Listed Threatened and Endangered Species American Indian Trust Resources Historic Buildings and Structures Cultural Landscapes Museum Collections

CLIMATE CHANGE

This chapter includes a description of past, present, and future conditions and trends for particular resource topics. Because climate change is an important factor widely recognized as having the potential to influence future trends in resource conditions, it is included as part of the description of the affected environment of wilderness units. The potential influences of climate change are described for the following resource topics: paleontological resources, vegetation, wildlife, archeological resources, and ethnographic resources.

By the year 2100, according to the Environmental Protection Agency (1998), average temperatures in Arizona are projected to increase by 3–4 degrees Fahrenheit (°F) in

spring and fall, and by 5°F in winter and summer. As a result, the climate of Arizona will likely become more variable, characterized by an increase in the frequency and intensity of extreme weather (e.g., storms, droughts, floods, prolonged periods of hot and cold temperatures) and other associated natural events (e.g., wildfires and pest infestations). Precipitation is also expected to become more variable, and the Environmental Protection Agency estimates a slight decrease in summer precipitation and an increase in fall, winter, and spring precipitation.

Other climate models predict different results, especially regarding regional precipitation patterns and trends. In fact, there is broad consensus among climate models that the Colorado Plateau will become more arid with periodic droughts that are more severe and possibly of longer duration (Seager et al. 2007).

IMPACT TOPICS INCLUDED FOR DETAILED ANALYSIS

NATURAL RESOURCES

As described previously in this document, the natural quality of wilderness character is integrated as part of the natural resources section of the environmental assessment.

Soils

Soils found within the wilderness areas are composed primarily of silts, clays, and sands derived from erosion of the Chinle Formation. The most fertile soils are generally found in the shortgrass prairies between the mesas and badlands, as well as on many of the mesa tops. These soils are composed of alluvial and windborne sands, making the soils quite permeable. The badland soils are composed of material from shales and have low permeability and high salt content. These clayey soils are particularly inhospitable to vegetation because water is held at a tension that is too high for plant roots to overcome, making water effectively unavailable to them. As a result, in this arid environment, the presence of clayey soils significantly limits the potential for development of organic soils and vegetation.

Park soils are generally characterized by four soil associations: Moenkopie-Sandstone, Tours-Jocity, Badland-Claysprings, and Clovis-Palms-Hubert. The Moenkopie-Sandstone association is characterized by well-drained, shallow and very shallow, nearly level to moderately sloping loamy sands formed in material eroded from sandstone and sandstone rock outcrops. The Tours-Jocity association consists of well-drained, deep, and nearly level to gently sloping clay loams and sand clay loams formed in alluvium (stream sediments). The Badland-Claysprings association is characterized by barren, eroded land, and well-drained, undulating clays formed in material eroded from clayey shales. Finally, the Clovis-Palms-Hubert association consists of well-drained, deep, nearly level to undulating loamy sands and gravelly loams formed in eolian (wind-blown) sands and alluvium. More information on soils can be found in the *General Management Plan Revision* (NPS 2004).

In addition to recognized soils, biological soil crusts (formerly called cryptobiotic soils) also occur within the park, including the backcountry and wilderness areas. In more arid regions, vegetation cover is generally sparse. Open spaces may be covered by these soils, which are a highly specialized community of cyanobacteria, mosses, and lichens. Biological soil crusts create a surface crust of soil particles bound together by organic materials that provide soil stability and resistance to wind and water erosion. Biological soil crusts also have an effect on plant germination and growth, appearing to enhance the ability of certain plants to survive in arid environments (NPS 2004).

Paleontological Resources (including petrified wood and other fossils)

Paleontological resources are identified as part of the "other features and values" that contribute to the park's wilderness character. The park wilderness area includes a substantial portion of the fossil-bearing Chinle Formation, which formed between 205 and 220 million years ago during the Late Triassic period of earth's history. The Chinle Formation gives clues on the depositional system (e.g., rivers, lakes, and swamps), climate, and position on the globe, as well as containing a wealth of plant and animal fossils. The formation details and tracks 15 million years of ecosystem evolution.

There is high potential for discovering fossilized remains of early dinosaurs,

amphibians, insects, fish, and other plants and animals. Plant fossils include leaves, stems, seeds, spores, and pollen from a variety of plant species including lycopods, tree ferns, cycads, bennittitales, and horsetails. Animal fossils include herbivorous aetosaurs, large carnivorous rauisuchians, phytosaurs, and giant, flat-headed amphibians called metoposaurs. Aquatic invertebrates include crayfish, snails, clams, and conchostracan (clam-shrimp). The potential is also high for finding fossilized insects such as beetles. Fish species, such as freshwater sharks, are also present.

Ongoing erosion from wind and rain threaten these paleontological resources once they are exposed. This is especially true of fossilized bones, which are extremely fragile and very susceptible to erosion processes. It is known that many Late Triassic fossils have been lost in the wilderness area because of natural weathering. This phenomenon will likely be exacerbated by climate change due to projected increases in the frequency and intensity of storms in Arizona, which can increase erosion and weathering processes. One exception to this is agatized petrified wood that consists almost entirely of silica, which is actually more resistant to erosion than even the surrounding rock. Once exposed to the elements, collection is the only major threat to agatized petrified wood.

Vegetation and Wildlife

Vegetation and wildlife are grouped together in this section because a discussion about wildlife typically involves a description of their habitat, which consists of the various vegetation communities found within the wilderness area.

The wilderness units contain six of the same vegetation groups as identified by the U.S. Geological Survey (USGS). These include the Colorado Plateau Mixed Bedrock and Tableland, Colorado Plateau Pinyon-Juniper Woodland, Inter-Mountain Basins Semi-Desert Grassland and Steppe, Inter-Mountain Basins Wash, and Southern Colorado Plateau Sand Shrubland. The north wilderness unit contains two additional vegetation groups: the Inter-Mountain Basins Greasewood Flat and Inter-Mountain Basins Riparian Woodland and Shrubland. Dispersal of vegetation in each of the wilderness units is shown on maps 5 and 6.

Table 8 shows each vegetation class type, its related group(s), and the extent to which each type is found in each of the wilderness units by acreage and percent. The vegetation type most predominant overall is the Badland Sparse Vegetation covering a little more than 36% of the total wilderness area. This is followed by the Alkali Sacaton Steppe and Mixed Grasslands vegetation, which covers a little more than 31% of the total wilderness area, and Sandsage – Fourwing Saltbush Colorado Plateau Shrubland with 19% coverage of the total wilderness area.

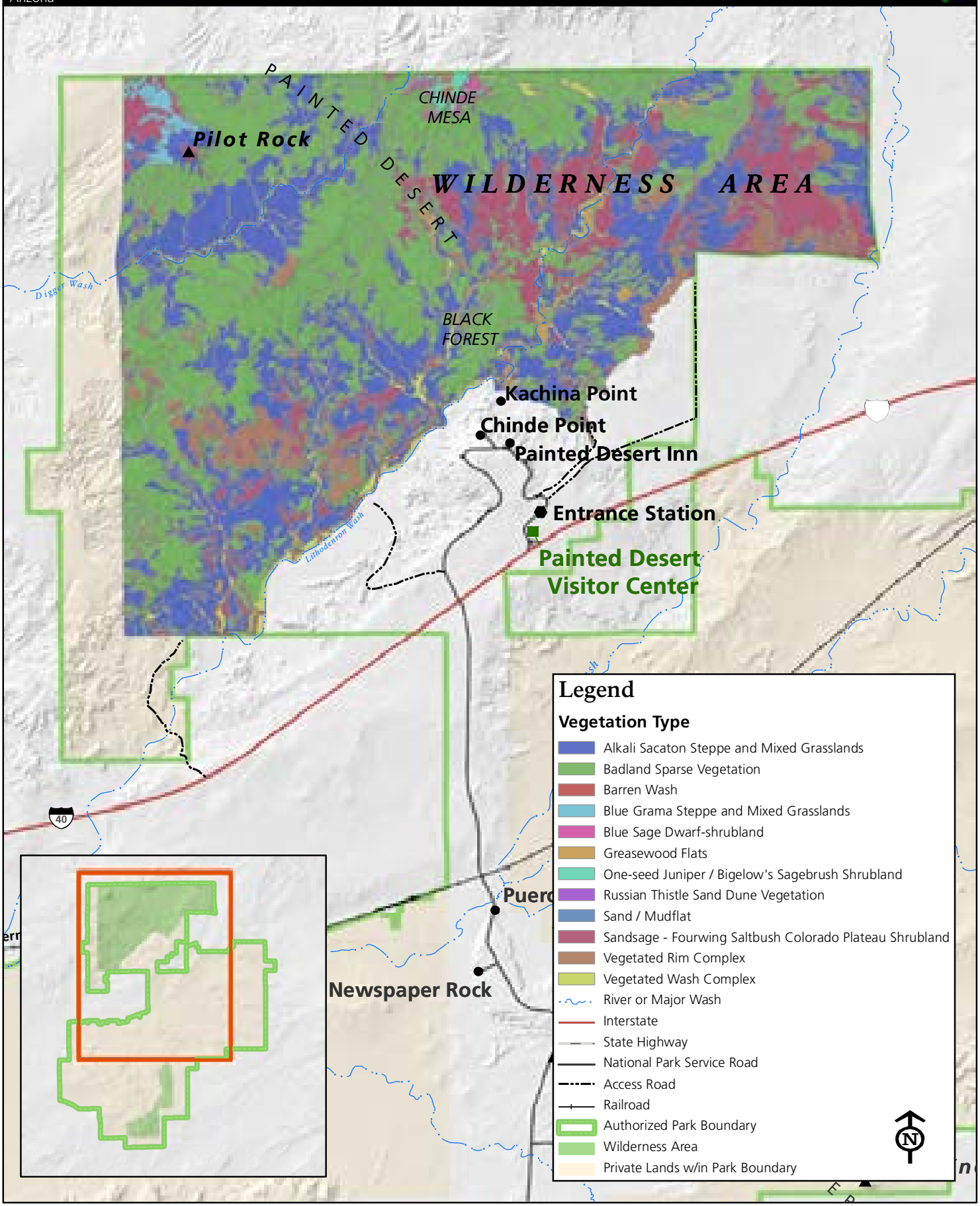
The predominant vegetation types in the north wilderness unit match is similar to that of the total wilderness area described above. In the south wilderness unit, the Alkali Sacaton Steppe and Mixed Grasslands predominate, followed by Sandsage – Fourwing Saltbush Colorado Plateau Shrubland and the Badland Sparse Vegetation.

The grasslands in the wilderness area are fire-dependent, relying on periodic fires to control the spread of woody plants and invasive species. Nonnative invasive plant species, such as Russian olive and tamarisk (or salt cedar), occur along the washes in the north wilderness area. These plants crowd out cottonwoods and willows, which in turn affects migrating and breeding bird species.

Vegetation Northern Wilderness Area

Petrified Forest National Park
Arizona

National Park Service
U.S. Department of the Interior



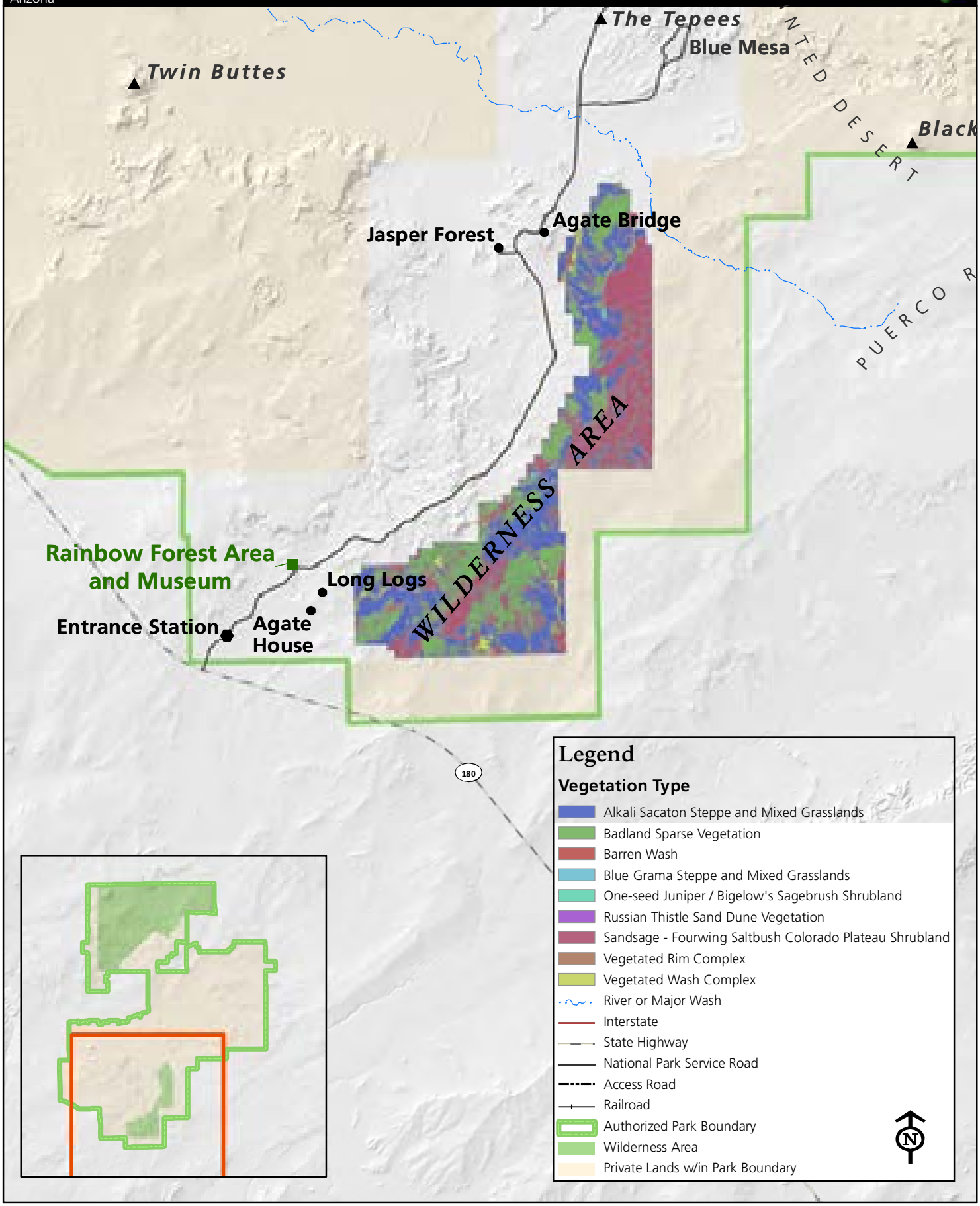
Produced by: NPS Denver Service Center Planning Division
December 2011

0 0.5 1 2 3 Miles

Vegetation Southern Wilderness Area

Petrified Forest National Park
Arizona

National Park Service
U.S. Department of the Interior



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0 0.5 1 2 3 Miles

TABLE 8. PETRIFIED FOREST NATIONAL PARK WILDERNESS AREA VEGETATION

Vegetation Class Type	Related Group(s)	Acreage in North Unit	% in North Unit	Acreage in South Unit	% in South Unit	Total Acreage	Total %
Alkali Sacaton Steppe and Mixed Grasslands	Inter-Mountain Basins Active and Stabilized Dune; Inter-Mountain Basins Semi-Desert Grassland and Steppe	16,019.15	29.87	4,737.28	36.05	20,756.43	31.1
Badland Sparse Vegetation	Inter-Mountain Basins Semi-Desert Grassland and Steppe	21,121.12	39.39	2,981.81	22.69	24,102.93	36.1
Barren Wash	Inter-Mountain Basins Wash	730.67	1.36	57.06	.43	787.73	1.18
Blue Grama Steppe and Mixed Grasslands	Inter-Mountain Basins Semi-Desert Grassland and Steppe	1,151.11	2.15	32.11	.24	1,183.22	1.77
Blue Sage Dwarf-shrubland	Inter-Mountain Basins Semi-Desert Grassland and Steppe	214.54	0.40	0	0	214.54	0.32
Greasewood Flats	Inter-Mountain Basins Greasewood Flat	521.61	0.97	0	0	521.61	0.78
One-seed Juniper/Bigelow's Sagebrush Shrubland	Colorado Plateau Pinyon-Juniper Woodland	479.35	0.89	7.97	.06	487.32	0.73
Russian Thistle Sand Dune Vegetation	Inter-Mountain Basins Active and Stabilized Dune	5.50	0.01	6.01	.05	11.51	0.02
Sand/Mudflat	Inter-Mountain Basins Semi-Desert Grassland and Steppe	6.91	0.01	0	0	6.91	0.01
Sandsage – Fourwing Saltbush Colorado Plateau Shrubland	Southern Colorado Plateau Sand Shrubland	8,200.40	15.29	4,646.40	35.36	12,846.80	19.2
Vegetated Rim Complex	Colorado Plateau Mixed Bedrock and Tableland; Inter-Mountain Basins Semi-Desert Grassland and Steppe	3,044.27	5.68	160.97	1.22	3,205.24	4.80
Vegetated Wash Complex	Intermountain Basins Riparian Woodland and Shrubland; Intermountain Basins Wash	2,126.62	3.97	512.44	3.90	2,639.06	3.95

Source: USGS 2011; NPS 2009

Wildlife is concentrated in the shortgrass prairie ecosystem. Pronghorn, black-tailed jackrabbits, desert cottontails, and coyotes are common wildlife species found in this area. Many bird species, such as flycatchers, warblers, and sparrows migrate through the park in spring and fall, relying on insects and seeds found in the shortgrass prairie and mixed desert shrubland to sustain them. Common reptiles include collared lizards, sagebrush lizards, Painted Desert whiptail lizards, and Hopi rattlesnakes. Prairie dogs have been documented within park wilderness areas, but black-footed ferrets have not.

Climate change will likely affect vegetation and wildlife communities of park wilderness areas because of projected increases in annual temperatures, extreme weather, seasonal variability of precipitation, and prolonged periods of drought. However, the rate and magnitude of these changes to specific populations of plants and animals is difficult to predict.

It is unclear how precipitation patterns will change; however, extended periods of drought could decrease vegetation cover and the availability of water for wildlife. If followed by storms, reduced vegetation cover could exacerbate erosion problems and loss of topsoil, which could further degrade plant communities and wildlife habitat.

Warming temperatures would likely alter the composition of native vegetation and wildlife communities and increase problems related to insects and disease. Climate change could also influence migration timing, range, and food sources of wildlife species.

The wilderness area is part of the migration corridor of one wildlife species of particular management interest that is not listed as a special status species by either the U.S. Fish and Wildlife Service (USFWS) or Arizona Department of Game and Fish. Because it is not included in the next section, "Federal and State Listed Species," a brief discussion follows.

Pronghorn. Pronghorn (*Antilocapra americana*) are known to inhabit the area, supported by expansive shortgrass prairies and intermittent availability of water from numerous human-made stock tanks distributed across the ranchlands. The size of their population and the extent of their home range have likely fluctuated considerably over time as a result of changing habitat quality, land uses, and climate patterns. Drought conditions in the past have taken a toll on pronghorn populations because of a dramatic reduction in forage availability. This was likely compounded by competition with livestock because this small ruminant feeds on succulent, high-protein vegetation also sought by livestock. Its home range has been modified by fences, highways, and railways within and along the border of the park, including along the wilderness area. These barriers restrict pronghorn movements, reduce genetic diversity, and affects its ability to find food in areas where vegetation is sparse.

CULTURAL RESOURCES

Archeological Resources

As described previously in this document, archeological resources are identified among the "other features and values" that contribute to the park's wilderness character. Archeological resources in Petrified Forest National Park span thousands of years of prehistoric use and settlement associated with American Indian populations. The Puerco River valley provided a natural corridor for trade, travel, and migration for many diverse cultural groups. Over 700 prehistoric sites have been recorded in the park representing the Paleo-Indian, Archaic, Basketmaker, and ancestral Puebloan cultural periods. Historic Navajo sites have also been identified. A wide array of site types exist ranging from small campsites, lithic and ceramic scatters, pictographs and

petroglyphs, house structures, and large pueblo sites. Spanish explorers are thought to have visited the Painted Desert region perhaps as early as the 16th century. Historic archeological resources may potentially exist associated with their expeditions and other activities through the 18th century. Archeological resources and artifacts identified from later Mexican and Anglo American periods of exploration and settlement have been identified. Several of the park's archeological sites are listed in the National Register of Historic Places for their ability to yield information important in Southwest prehistory and history.

Prehistoric Resources. From approximately 13,500 BC to 6000 BC, at the close of the last ice age, small bands of Paleo-Indian hunters and gatherers pursued large Pleistocene megafauna (mammoth and other now-extinct species of bison, horse, camel, and other game animals) across North America. In the Southwest and the Colorado Plateau region, native people encountered cool, savannah-like conditions that supported grasses, edible plants, and the large animals they hunted. Although archeological evidence of Paleo-Indian activities is scarce, the Clovis and Folsom cultures that emerged during the period are noted for their distinctive fluted, lanceolate-shaped projectile points. Surface finds of Paleo-Indian projectile points (some made from locally procured petrified wood) have been found in the park (NPS 2004; Zedeno et al. 2001).

The subsequent Archaic period (ca. 6000 BC to AD 300) reflected regional cultural adaptations to the warmer and more desert-like climatic conditions of the Southwest. Archaic period people became more sedentary, and broadened their subsistence base to include many different plant and animal species. Among the cultural items associated with the period are manos (hand-held grinding stones) and metates (stone grinding basins) for processing seeds and grains. The manufacture and use of ceramic pottery had not yet developed during the Archaic period. Projectile points and other lithic artifacts diagnostic of the period have been found in the park (NPS 2004; Zedeno et al. 2001).

The Basketmaker II and III periods (ca. AD 300 to AD 700) followed the Archaic period in the Southwest. Basketmaker people became increasingly sedentary, and (during Basketmaker III) moved from the mesa tops to lower-lying areas where they constructed stone-lined pit houses and cultivated corn, squash, and beans to supplement their hunting and gathering activities. Along with intricately fashioned fiber baskets and woven bags, they made clay pottery (an undecorated type known as Adamana Brown), and adopted the use of the bow and arrow about AD 500. Archeological remains of Basketmaker pit houses, single- and multiroom dwellings, petroglyphs, and artifact scatters have been identified throughout the park. National register-listed Basketmaker sites in the southern portion of the park include the Twin Buttes Archeological District (a partially excavated late Basketmaker III site consisting of scattered house groups) and the Flattop site (another excavated early pit house complex southwest of the Twin Buttes district) (NPS 2004; Burton 1991; Stewart 1980).

The Ancestral Pueblo period began ca. AD 700 and marked a transition from the previous Basketmaker culture as local inhabitants began occupying small settlements (pueblos) on the upland terraces along watercourses and near arable lands. A major drought occurred during the first part of the Pueblo I period, with evidence of regional population stress in the archeological record. However, climatic conditions improved following the drought, which supported increased populations and more stable settlements. The Petrified Forest area emerged as an important contact point where goods and objects were exchanged from regional cultural groups, notably the Western Pueblo, Mogollon, and Sinagua cultures. A large percentage of the sites recorded in the park are from the Pueblo II and III periods (AD 950 to 1300). Sites include single- and multiroom pueblos with kivas (ceremonial pit houses), lithic and ceramic

artifact scatters, rock shelters, and extensive petroglyph panels. Puerco Pueblo and Agate House (both listed in the National Register of Historic Places) were built during the Pueblo period (NPS 2004).

Another period of prolonged drought (ca. AD 1271 to 1296) occurred toward the end of the Pueblo III period. The event had a destabilizing effect on regional populations and likely contributed to the relocation of various cultural groups to larger and more centralized settlements in the Rio Grande valley, Acoma and Zuni country, the Hopi mesas, the White Mountains, and other outlying areas. Comparatively few sites associated with the ensuing Pueblo IV period (ca. AD 1300 to 1450) have been recorded in the park although the greatest concentration occurs within 1 mile of Puerco Pueblo. The Kachina Cult emerged during this period with Kachina figures depicted in rock art and kiva murals. At the height of its development, around AD 1300, Puerco Pueblo is thought to have housed about 200 people in a one-story, 100- to 125-room sandstone block structure with a rectangular plaza. Puerco Pueblo appears to have been systematically abandoned around AD 1380, and most of the Petrified Forest area appears to have been depopulated by the close of the 15th century as the Pueblo IV period ended in the region (NPS 2004; NPS website "Puerco Pueblo" n.d.).

The Navajo are thought to have moved to the region in the 15th century. Initially a nomadic people relying on hunting for sustenance, the Navajo later incorporated limited farming and sheep/livestock herding (a practice acquired from Spanish colonists) into their subsistence base. An early Navajo site dating to approximately AD 1750 was recorded in the Flattops area (NPS 2004; Zedeno et al. 2001).

Historic Archeological Resources. Historic archeological resources have been found throughout the park, primarily associated with exploration, pioneer travel, and settlement during the Mexican and Anglo-American periods of the 19th and early 20th centuries. Earlier Spanish explorers are thought to have crossed the area, and a potential exists for archeological evidence of their activities from the 16th through 18th centuries. During the 19th century, exploratory surveys of transportation routes along the 35th Parallel crossed the Painted Desert badlands. These included the U.S. Army expedition of 1853 under the command of Lt. Amiel Whipple, and the subsequent wagon road surveyed and constructed between 1857 and 1859 by Lt. Edward F. Beale, who commanded the army's experimental Camel Corps on his first survey expedition. The Beale wagon road became a prominent route used by California-bound immigrants prior to the Civil War, and was later used by settlers and stagecoach companies. Traces of Beale Road are still evident and are listed in the national register. The route was subsequently followed by the Atchison, Topeka, and Santa Fe Railroad, Route 66, and Interstate 40 (NPS 2004). Homesteaders and ranchers settled the region during the latter 19th century and archeological evidence of historic roads and ranching activities is found in the park. Sites representing the camps and excavations of early 20th century paleontological researchers have also been identified, as well as resources related to the contributions of the Civilian Conservation Corps to park preservation undertakings and development during the 1930s (NPS 2004).

Petrified Forest National Park Wilderness Investigations. Between 2003 and 2005, NPS archeologists surveyed more than 9,000 acres of designated wilderness of the park (2,287 acres in the north [Painted Desert] wilderness unit, and 6,735 acres in the south [Rainbow Forest] wilderness unit). Named the "Spirit of the Wilderness Survey," it constituted the largest contiguous block survey carried out in the park to date. Sixty-three previously undocumented sites were recorded, and most (56) dated to the Pueblo II and Pueblo III periods. Discovered sites were primarily concentrated in the south (Rainbow Forest) wilderness unit on sandy bluffs overlooking deeply eroded badlands areas. Several sites included ceramic artifacts and rock art that supported a range of occupation from

Basketmaker to Pueblo IV periods. Northern Arizona University staff assisted NPS field archeologists in characterizing and dating the diverse range of ceramic artifacts identified by the archeologists. All but three of the sites were recommended eligible for the national register (NPS 2008; NAU 2005).

Potential Threats to Archeological Resources. Archeological resources in the park are subject to the damaging effects of wind and water erosion. These natural processes can expose artifacts and deflate the stratigraphic layering of site soils, diminishing the valuable context of archeological information that a site may retain in an undisturbed condition. Erosional processes can also undermine the structural integrity of prehistoric building features such as pit house and pueblo wall remnants. Visitor use activities can adversely impact sites as a result of unintentional social trails contributing to site erosion, as well as other deliberate acts such as site looting (the illegal collection of artifacts) and defacement of petroglyphs and pictographs.

Climate change is also anticipated to adversely affect archeological resources as a result of the intensification and increased frequency of severe storm activity contributing to wind and water erosion. Periods of drought may reduce vegetation cover further exacerbating site erosion (NPS 2010). In September 2010, researchers from Arizona State University initiated a project to monitor the variability of the region's "microclimates" to assess their associated effects and connections with climate change. Small, noninvasive monitoring stations were set up at five archeological sites in the park having different environmental conditions to monitor air temperature, humidity, and precipitation. Data collected by the project is anticipated to document erosion and weathering factors across different environments, and will be used to assist archeological site protection efforts as well as natural resource management and visitor safety. The project, the first to systematically record internal climate variability in the park, is scheduled to end in March 2012.

Ethnographic Resources

As defined by the National Park Service, an ethnographic resource is "a site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 28). Ethnographic resources typically hold significance for contemporary, traditionally associated groups whose sense of purpose, existence as a community, and identity as an ethnically distinctive people are closely linked to particular resources and places. Although a formal ethnographic landscape evaluation of Petrified Forest National Park has not been undertaken, information acquired from ethnographic investigations strongly suggests that the park (or portions thereof) can be considered an ethnographic landscape retaining complex cultural importance for several regional tribes. Ethnographic landscapes typically comprise a variety of natural and cultural resources (e.g., settlements, sacred sites, geological features, plant and animal communities, subsistence and ceremonial use areas).Many of these defining elements of ethnographic landscapes are found or are likely to exist throughout the park's wilderness areas, reinforcing contemporary tribal connections to the environment and landscape.

An *Overview and Inventory of Ethnographic Resources* (2001) for Petrified Forest National Park, El Malpais National Monument, and El Morro National Monument was completed by the University of Arizona – Bureau of Applied Research in Anthropology. At Petrified Forest National Park, researchers consulted on-site with tribal representatives of the Hopi Tribe, the Pueblo of Zuni, and the Navajo Nation. Information conveyed by tribal members as part of these investigations confirmed that the park holds profound cultural importance. Long-standing tribal connections to places and resources in the park and surrounding region are linked to the traditional knowledge and oral histories passed down from ancestral generations to present-day tribal members.

Spanish explorers recorded accounts of the region's indigenous peoples in their journals, and during the early 20th century anthropologists provided some of the region's earliest detailed ethnographic reports. However, information regarding specific ceremonial or resource use locations remains relatively limited. Many tribal members have understandably been reluctant to disclose specific information to outside groups in efforts to protect sensitive places and aspects of their cultural heritage (Zedeno et al. 2001).

As noted in the 2001 ethnographic overview, the Zunis and Hopis consider Petrified Forest National Park and outlying areas to be directly associated with ancestral migrations leading to the ultimate settlement of their present tribal villages (i.e., Zuni Pueblo in northwestern New Mexico and the Hopi mesas in northeastern Arizona). Particular natural landmarks, landforms, and shrines mark the boundaries of lands that traditionally extended far beyond the limits of present reservations. The ruins of former habitation areas, such as Puerco Pueblo and other archeological sites, remain culturally important as the places where tribal ancestors settled during their migrations, grew crops, gathered plants, hunted, and performed rituals and ceremonies. Petroglyphs, commonly found near former pueblo sites and migration routes, provide symbolic evidence of the clans and medicine societies that occupied and passed through the area. Many petroglyphs can be interpreted by present-day clans and societies. Tribal representatives identified the cultural importance of water sources (e.g., the Puerco River and unspecified springs), various plants, animals, and rocks/minerals (e.g., petrified wood and colored sand), and noted the continuing utilization and procurement of resources in and around the park for traditional ceremonial and domestic purposes. Tribal members customarily place offerings of prayer feathers and other materials at sacred shrines to reinforce spiritual connections with particular places and regions (Zedeno et al. 2001).

Petrified Forest National Park is within the traditional boundaries of the Navajo Nation, and is directly south of the boundary with the Navajo Reservation. In common with the Hopis and Zunis, the Navajos continue to use lands in and around the park for plant and mineral collection, religious purposes, and hunting. Places in the park figure prominently in Navajo oral history and legends, and at least three places in the Painted Desert portion of the park hold sacred significance for the tribe. Navajo families historically farmed plots along the Puerco River. Because the Navajos primarily built temporary shelters for summer herding activities, little physical evidence of their habitation in the area remains. There is a potential, however, for the discovery of hogan and sweat lodge sites (Zedeno et al. 2001).

Tribal representatives provided several recommendations for the protection and preservation of ethnographic resources and the continuation of traditional activities in the park (Zedeno et al. 2001). Among these, it was recommended that:

- Traditionally associated tribal members should continue to be provided access to sacred places to conduct ceremonies necessary to restore water and rainfall to the area, place offerings, and gather resources for ritual and medicinal purposes.
- The National Park Service should limit or eliminate backcountry trails and roads, and monitor and control visitor numbers to protect archeological and ethnographic sites from trampling and looting.
- Livestock grazing in the park should be prohibited, along with other measures to stop soil erosion and the loss of valuable plants and grasses.
- The National Park Service should reevaluate the placement of fences and roads that can impede the access of animals such as pronghorn to water and grazing areas.

- The general public should be restricted or discouraged from accessing particularly sensitive places of tribal importance.

The park extended invitations to Navajo, Zuni, and Hopi representatives in November 2011 to consult on the Wilderness Stewardship Plan. Tribal representatives met with park staff and concurred with NPS management efforts to keep the wilderness areas as pristine as possible. The protection of archeological resources was of particular concern to the representatives. They also encouraged the park to monitor resource conditions and to undertake suitable measures to prevent resource damage and unauthorized access into wilderness.

Potential Threats to Ethnographic Resources. Because many of the archeological resources and sites in the park also retain ethnographic importance; they are similarly subject to the damaging effects of wind and water erosion. These natural processes can disturb the archeological and ethnographic information that a site may possess in an undisturbed or in situ condition. Erosional processes can also undermine the structural integrity of prehistoric building features such as pit house and pueblo wall remnants. From the perspective of many tribal members, these processes are expected and represent the cyclical return of natural materials back to the earth from which they were originally collected and used for cultural purposes. The visitor use activities of the general public can also adversely impact ethnographic sites and resources as a result of unintentional social trails contributing to site erosion, as well as other deliberate acts such as site looting, the illegal collection of artifacts, and defacement of petroglyphs and pictographs. Actions that could limit or restrict traditional tribal access to places of cultural and sacred importance also represent potential threats to the connections that tribal members maintain with their ancestral homelands.

American Indians in the Southwest have adapted to periods of prolonged drought at several times in their histories, although these episodes undoubtedly stressed populations and resulted in widespread relocations. The present anticipated consequences of climate change are also anticipated to adversely affect ethnographic resources and potentially the cultural connections that contemporary tribes have with traditional resources and places. This could occur as a result of the intensification and increased frequency of severe storm activity contributing to wind and water erosion. Periods of drought may reduce vegetation cover further exacerbating site erosion, and potentially reduce or alter the diversity and distribution of culturally important plant and animal species in the region.

VISITOR USE AND EXPERIENCE

Parkwide Visitor Use and Characteristics

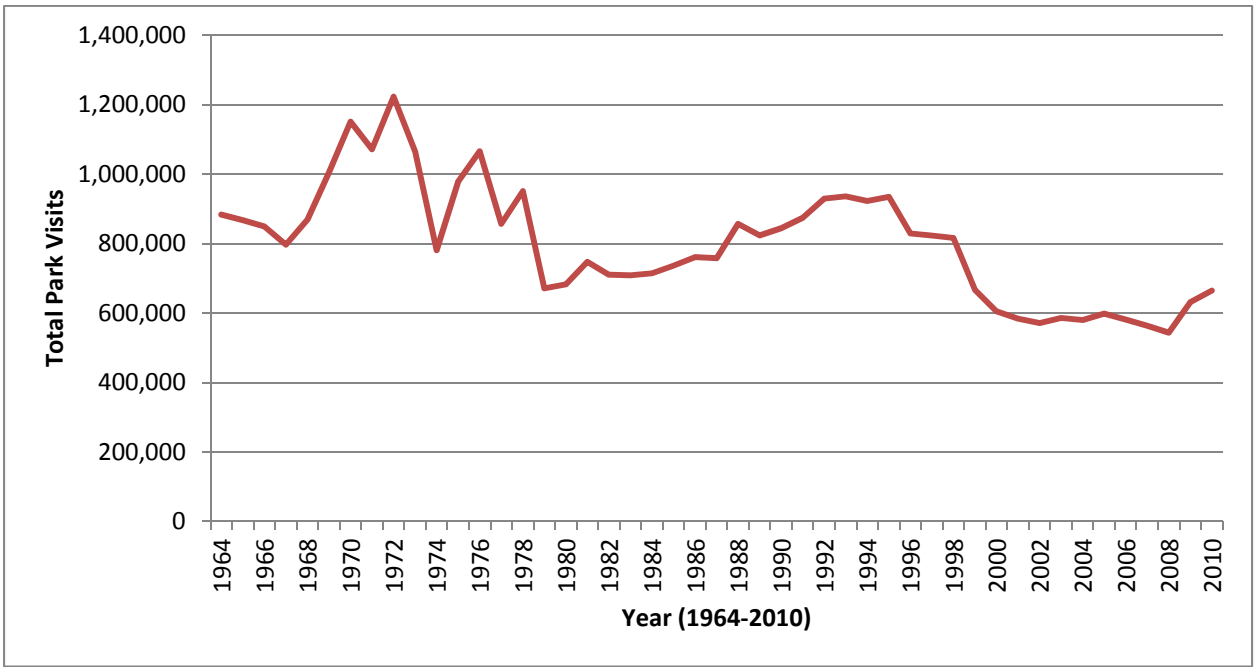
Visitation to Petrified Forest National Park was at peak levels in the 1970s, with over 1.2 million visitors annually. Visitation declined into the 1980s, and rose again in the mid to early 1990s with more than 900,000 visitors per year. Although use levels have declined since the 1990s, visitation has remained relatively stable since 2001 with use gradually increasing to 664,725 visitors in 2010 (figure 2). Monthly visitation peaks in June and July (figure 3). However, visitation remains high throughout the summer; January and February are typically the slowest months. As shown in figures 4 and 5, only a small proportion of total park visitors are overnight campers. For example, figure 4 shows that a total of 300 visitors camped overnight in 2010. Although all park camping is currently designated to occur within the wilderness boundaries, there has been confusion about the location of boundaries and many visitors have set up camp within the backcountry zone before entering wilderness boundaries.

There is little recent information about the characteristics of visitors at Petrified Forest National Park, but a 1997 petrified wood theft

study (Roggenbuck et al. 1997) and a 2001 visitor study (Lee, Hockenberry, and Delost 2002) provide some insights. The average length of stay in the park is about 2.5 hours. Visitors tend to be highly educated, and most come in family groups that include children. About one-quarter of the groups include someone over the age of 65. Visits by seniors and school groups tend to increase during the spring and summer. About 11% of visitors are California residents, with Arizona being the next most common state of residence. Petrified Forest National Park is not the primary destination for most visitors; instead the park tends to be one stop on an itinerary that includes other destinations such as Grand Canyon National Park; the Navajo and Hopi Indian reservations; and Flagstaff and Canyon de Chelly, Wupatki, Sunset Crater, and Walnut Canyon national monuments.

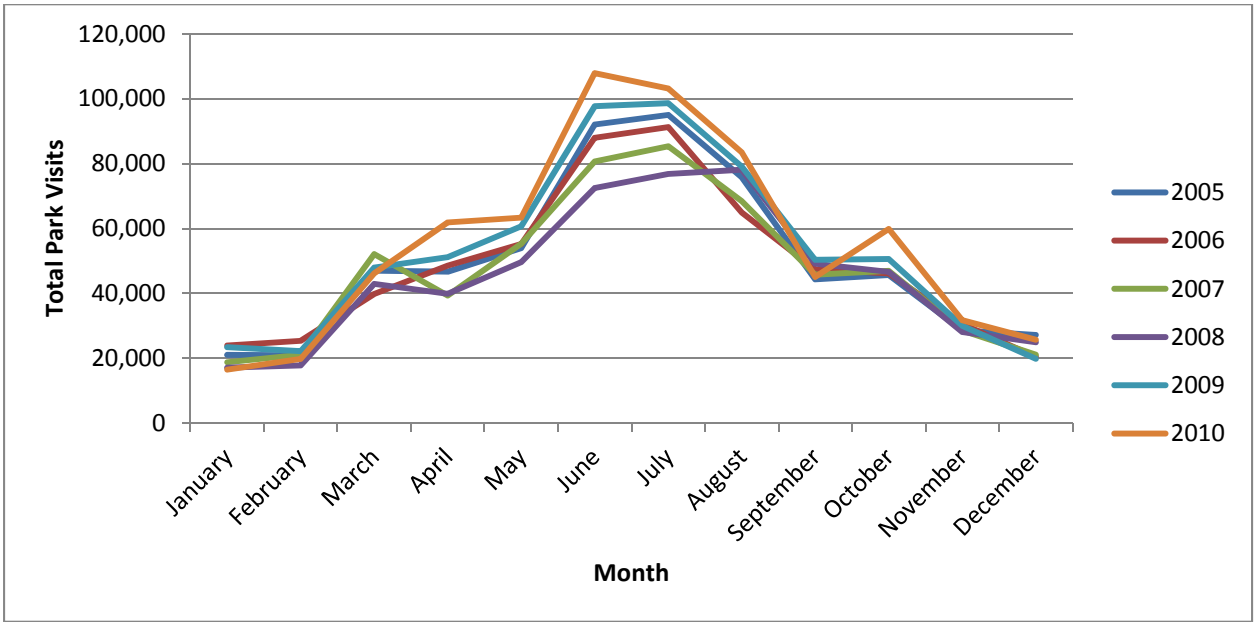
The most popular visitor activity is traveling the main park road and enjoying the scenery, with stops to see petrified wood and wayside exhibits and enjoy short hikes. Picnicking, watching wildlife, ranger-led walks, and enjoying indoor interpretive exhibits (main visitor center, Rainbow Forest Museum, and the Painted Desert Inn) are also popular activities. Day hiking and overnight back-packing are the most common backcountry experiences, but a relatively small proportion of visitors venture into the backcountry or wilderness units. A relatively small number of visitors ride horses in the national park. Much of the backcountry is managed as wilderness, where there are no maintained trails, no reliable water sources, and summer temperatures that can soar to more than 100°F. Thunderstorms can turn dry washes into rushing torrents.

The national park includes a gift shop, café, and gas station/mini-mart at the Painted Desert headquarters, and a gift shop and snack bar at Rainbow Forest. These concession services are provided under a contract with the National Park Service. The Petrified Forest Museum Association operates bookstores at the Painted Desert visitor center, the Rainbow Forest Museum, and the Painted Desert Inn.



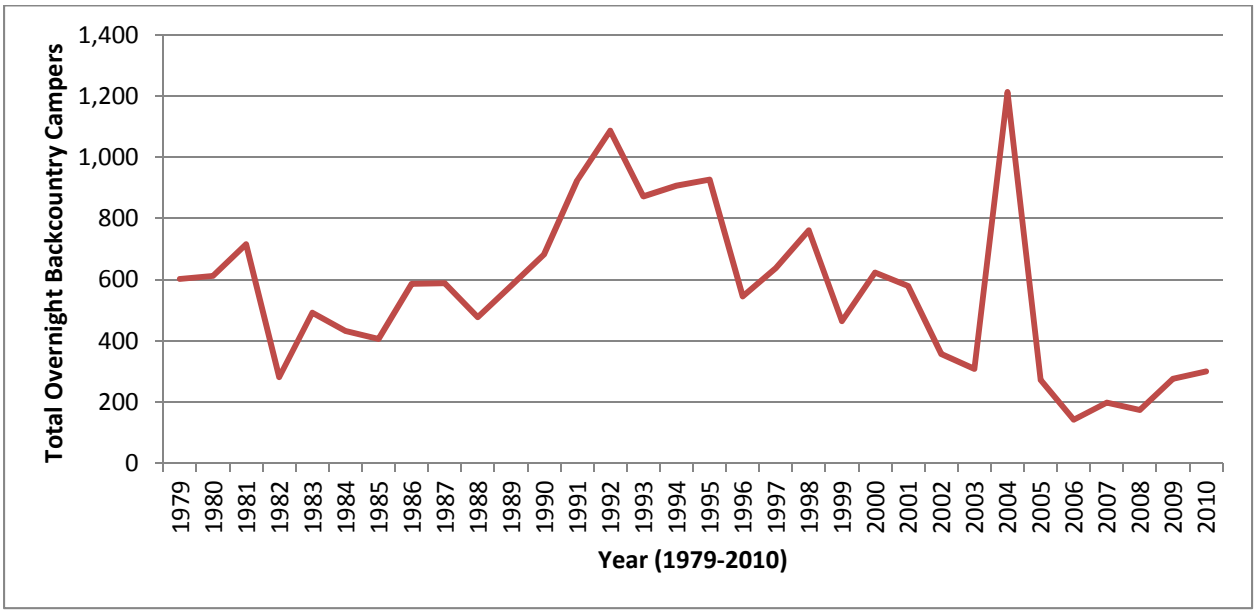
(NPS. Public Use Statistics Office 2011a)

FIGURE 2. ANNUAL PARK VISITATION



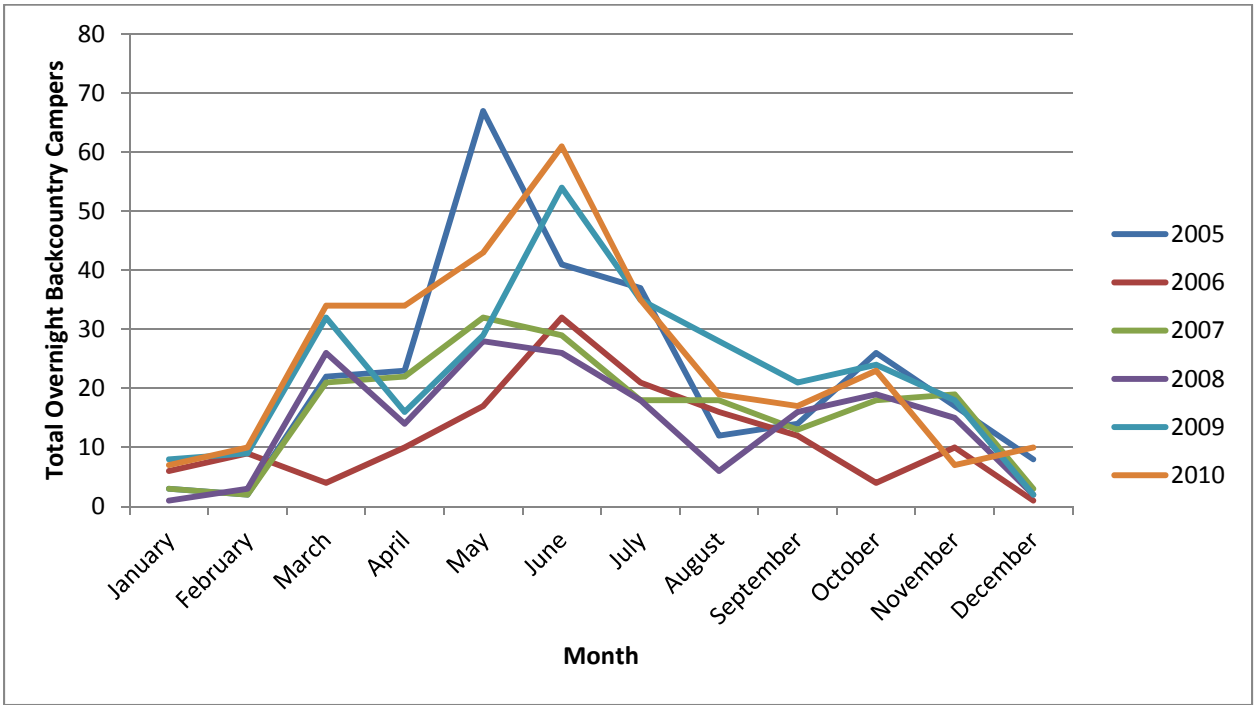
(NPS. Public Use Statistics Office 2011a)

FIGURE 3. MONTHLY PARK VISITATION



(NPS. Public Use Statistics Office 2011a)

FIGURE 4. ANNUAL VISITATION BY OVERNIGHT BACKCOUNTRY CAMPERS, 1979–2010



(NPS. Public Use Statistics Office 2011a)

FIGURE 5. MONTHLY VISITATION BY OVERNIGHT BACKCOUNTRY CAMPERS

There is basically no visitation in the new (addition lands) portion of the park. This is due to the current lack of public access routes; the checkerboard pattern of private, state, and federal land ownership; and other barriers (interstate highway, railroad corridor, and rivers and washes). However, the park staff is interested in building its local and regional visitor constituency and hopes that expanding and diversifying visitor opportunities on the addition lands during the long term would help to accomplish this.

Parkwide Visitor Experience

Experiencing the following aspects of Petrified Forest National Park has been identified as fundamental to the visitor experience (see GMP Amendment 2010):

- petrified wood deposits in a natural setting
- the renowned, colorful Painted Desert
- erosional processes that shape the landscape, and features such as mesas, buttes, badlands, lava flows, washes, and tinajas
- various ecosystems, such as shortgrass prairie, shrub steppe, riparian, and badlands
- archeological resources (petroglyphs, archeological sites)
- wilderness areas that lack trails, offer challenges, and provide opportunities for solitude
- dark night skies and natural soundscapes
- visibility – vast, expansive, open, and unobstructed views

Park wilderness areas provide expanded opportunities for visitors to experience the fundamental resources and values of the park. Of the fundamental resources and values listed above, the viewsheds, dark night skies, and natural soundscapes are discussed in

more detail because of the potential impacts from actions adjacent to the park, which warrant additional analysis (see the "Cumulative Scenario" section in chapter 4). Challenges to the pristine, undeveloped nature of the wilderness area are primarily external and beyond the control of the National Park Service. Surrounding development and industry can contribute to the degradation of dark night skies, natural sounds, and viewsheds as experienced from within the wilderness area. These developments include potash mining on private lands adjacent to the south wilderness unit, wind and solar energy development, light and visibility of a proposed casino and related development (i.e., hotels, campground, and gas station) at Pinta, communication towers along Interstate 40, and light emitting off the algae plant also near the south wilderness unit. The vastness of the landscape magnifies the impacts of these surrounding developments and is therefore more vulnerable to these threats.

Viewsheds

The park provides unparalleled scenic vistas because of the combination of exceptionally clear air, expansive landscapes, varied ecosystems, and the sheer distance of unobstructed views.

As part of the Southern Colorado Plateau Network (SCPN) Vital Sign monitoring program, extensive data on air quality has been collected at Petrified Forest National Park (Thomas et al. 2006). The two components of air resources include clear skies allowing for good visibility and low pollution. Air quality monitoring will continue to be monitored at Petrified Forest National Park by programs external to the SCPN inventory and monitoring effort. The SCPN relies on the Air Resource Division of the National Park Service for data collection, reporting, and summaries for class I parks. Under the Clean Air Act of 1970, Petrified Forest National Park has been rated as a class I park. Class I designations includes national parks, national wilderness areas, and national monuments; and are granted special air quality protection under section 162 (a) of the Clean Air Act (Thomas et al. 2006). A database of current and past air quality monitoring is maintained by the National Park Service Air Quality Division (NPS 2011b).

Dark Night Skies

National parks and wilderness areas are protective harbors for some of the last remaining dark skies in this country, and provide visitors with outstanding opportunities for stargazing due to the lack of artificial light. However, dark night skies are becoming increasingly rare throughout the country. In accordance with NPS *Management Policies 2006*, the National Park Service strives to preserve natural ambient lightscapes, which are natural resources and values that exist in the absence of human-caused light (NPS 2006b). Petrified Forest National Park strives to limit the use of artificial outdoor lighting to that necessary for basic safety requirements by shielding lights and taking precautions to minimize impacts upon wildlife, neighbors, and the viewshed.

Unspoiled natural lightscapes have ecological, cultural, and scenic importance, and the National Park Service is charged with their protection. Resource inventories constitute a critical first step for protecting dark night skies, and inform park managers about the nature of the resources. Inventories of night sky quality also contribute to air quality-related value assessments being completed servicewide. Baseline night sky data collection has occurred at Petrified Forest National Park, and is in the queue for analysis by the NPS Natural Sounds and Night Skies Division. Findings will help detect long-term changes and will provide scientifically sound data for wilderness stewardship.

Natural Soundscapes

The natural soundscapes of the wilderness areas enhance visitor opportunities to experience solitude in a vast and largely undeveloped remote desert setting. In accordance with 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 system units (NPS 2006b).

Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequency, magnitude, and duration of human-caused sound considered acceptable varies among national park system units as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

Visitor-caused noise can affect the natural soundscape by disrupting wildlife and by impacting visitor experience. Noise refers to as any human-caused sound that masks or degrades natural sounds (Lynch et al. 2011). While the severity of the impacts vary depending on the species being studied and other conditions, research strongly supports the fact that wildlife can suffer adverse behavioral and physiological changes from intrusive sounds (noise) and other human disturbances. Documented responses of wildlife to noise include increased heart rate, startle responses, flight, disruption of behavior, and separation of mothers and young (Selye 1956; Clough 1982; NPS 1994; USDA 1992; Anderssen et al. 1993). Masking degrades an animal's auditory awareness of its environment and fundamentally alters interactions among predators and prey. Masking also affects acoustical communication. Animals have been shown to alter their calling behavior and shift their vocalizations in response to noise (Brumm and Slabbekoorn 2005; Patricelli and Blickley 2006; Slabbekoorn and Ripmeester 2008; Warren et al. 2006). Vocal adjustment likely comes at a cost to both energy balance and information transfer; however, no study has addressed receivers.

A 1998 survey of the U.S. public revealed that 72% of respondents thought that providing opportunities to experience natural quiet and the sounds of nature was an important reason for having national parks, while another 23% thought that it was somewhat important (Haas Wakefield 1998). In another survey specific to park visitors, 91% of respondents considered enjoyment of natural quiet and the sounds of nature as compelling reasons for visiting national parks (McDonald et al. 1995). Acoustical monitoring provides a scientific basis for assessing the current status of acoustic resources, identifying trends in resource conditions, quantifying impacts from other actions, assessing consistency with park management objectives and standards, and informing management decisions regarding desired future conditions.

Acoustical data was collected in September 2004 and March 2010 by the Department of Transportation Volpe Center. This data represents the summer and winter seasons at Petrified Forest National Park (USDOT 2009). Acoustical stations were set up in the Painted Desert just north of Lithodendron Wash during both monitoring seasons (figure 6). Acoustical stations were also set up outside wilderness areas, but these results will not be discussed due to the focus on wilderness. At the Painted Desert monitoring station, the ground was composed of rock/ sand with little scrub vegetation. Results include measures of existing ambient levels, calculations of sound source durations, and estimates of natural ambient levels. Sounds audible at this site were primarily natural (wind-related and birds). Unnatural sounds included aircraft flyovers and faint vehicle noise (a "hum" from the distant interstate highway) depending on

which direction the wind was blowing, and occasional train-related sounds.

The data distribution indicates that day and night sound levels were generally similar for both seasons. Sound levels correlated closely with wind speeds throughout the day. Sound pressure levels are A-weighted (dBA) to more closely represent the sensitivity of the human ear to different frequency ranges. Humans do not hear well at very low or very high frequencies, so weighting adjusts for this.

The existing ambient condition (L_{50}) is the sound level exceeded 50% of the time, or median sound level. It is the current sound intensity of an area, including both natural and human-caused sounds. The natural ambient sound level (L_{nat}) estimates what the acoustical environment would be without the contribution of anthropogenic sounds. The differences between L_{50} and L_{nat} values provides answers the following questions:

- What are the listening opportunities in the absence of human development and activities?
- How are these listening opportunities compromised by increased sound levels due to noise?

September 2004 measurement | March 2010 measurement

FIGURE 6. ACOUSTICAL MONITORING STATION AT PAINTED DESERT NEAR LITHODENDRON WASH (USDOT 2011)

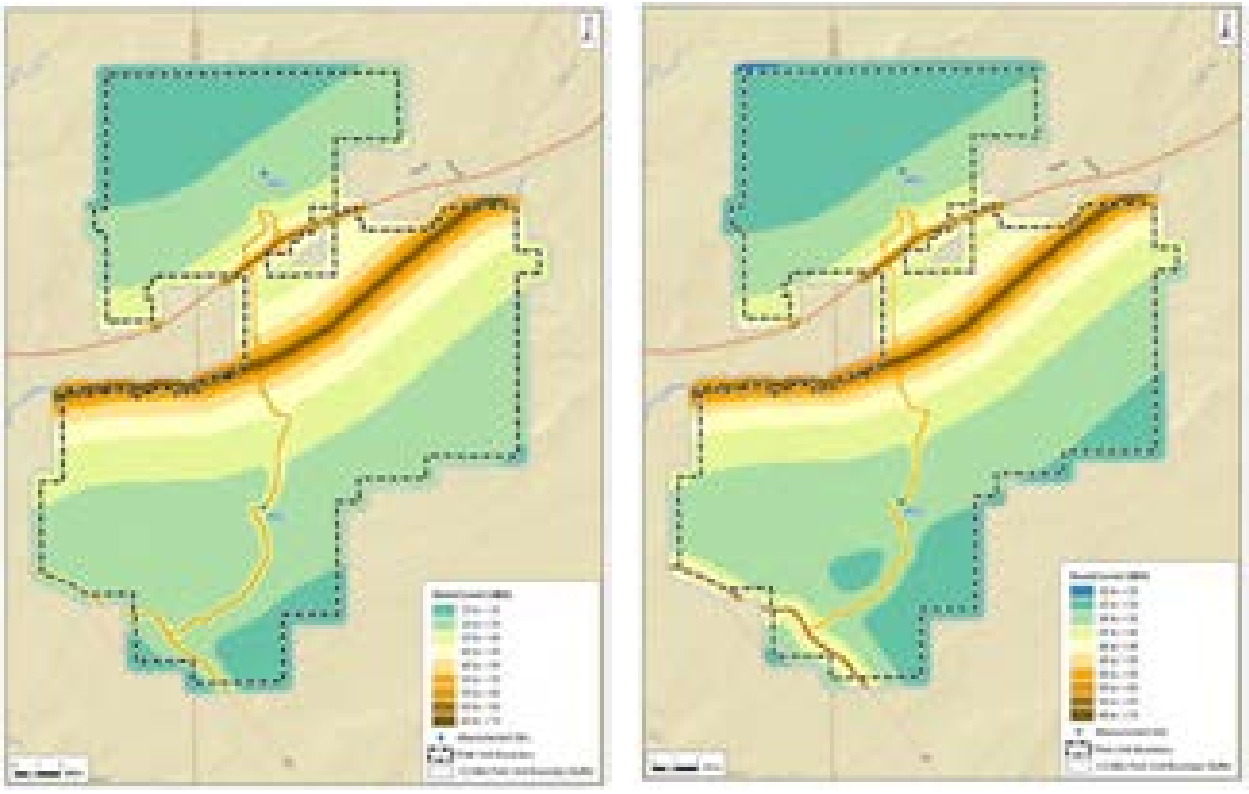
In general, summer daytime sound levels ranged from approximately 15 to 50 dBA (the L_{50} was 24.1 dBA); nighttime sound levels ranged from 15 to 40 dBA (the L_{50} was 19.7 dBA). The overall winter daytime L_{50} was approximately 3 dBA less than the summer (figure 7). The maps shown in figure 7 demonstrate approximate existing ambient sound levels (without the contribution of air tours) across the park for the summer and winter seasons. The location of the Painted Desert acoustical monitoring station is labeled as PF1. For detailed information on acoustical mapping methodology, please see the summary report (USDOT 2011).

On-site observations and off-site review of recorded audio data (figure 8) concluded that human-related sounds (e.g., aircraft, traffic, and occasional trains) were audible at this site 38.3% of daytime hours (7:00 a.m. to 7:00 p.m.) during the summer season (noise free 61.7% of the day); aircraft were audible 35.8% of daytime hours. Other human-caused

sounds at this site were mostly from visitors along the trail. During the winter, human-related sounds (aircraft, traffic, and trains) were audible 22.9% of daytime hours (noise-free 77.1% of the day); aircraft were audible 22.3% of the time. Natural sounds during both seasons were primarily wind-related. Natural ambient conditions were not calculated for nighttime. It should be noted that management activities in and around the wilderness could influence the natural soundscape condition. For more information on acoustical monitoring results, please see the summary report (USDOT 2011).

Opportunities and Experiences of Solitude or Primitive and Unconfined Recreation in Wilderness

As described in *Keeping it Wild*, an interagency strategy to monitor trends in wilderness character across the national wilderness preservation system, wilderness areas should provide outstanding opportunities for solitude or primitive and unconfined recreation (Landres et al. 2008). This quality is degraded by settings that reduce these opportunities such as encounters with other wilderness visitors, signs of modern civilization adjacent to the wilderness area that affect these opportunities inside wilderness, facilities provided by the agency or created by users that reduce the self-reliance of people, and management restrictions on visitor behavior.



Summer Winter

FIGURE 7. PARKWIDE BASELINE AMBIENT MAP: EXISTING AMBIENT SOUND LEVELS (WITHOUT THE CONTRIBUTION OF AIR TOURS) FOR THE SUMMER AND WINTER SEASONS (USDOT 2011).

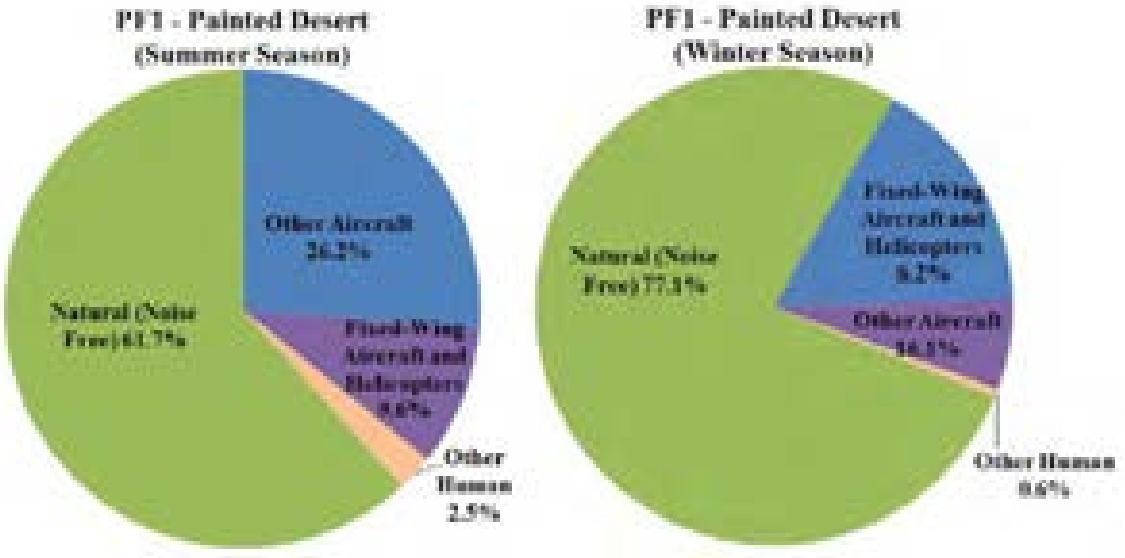


FIGURE 8. DISTRIBUTION OF SOUND SOURCES AUDIBLE (FIELD AND OFFICE LISTENING COMBINED RESULTS) FOR PAINTED DESERT MONITORING STATION (USDOT 2011).

The *Keeping It Wild* interagency strategy considers recreation-focused developments (such as trails, campsites, shelters, or toilets) under the solitude or primitive and unconfined recreation quality because of the strong connection of the latter quality to recreational experiences.

The Petrified Forest National Park Wilderness Area evokes a special sense of place for visitors that explore this vast and open landscape. With low visitation and lack of infrastructure, the wilderness areas provide opportunities for solitude, and are the epitome of primitive and unconfined types of recreation. With no trails, no signs, no accessible water sources, and no campsites; visitors must come prepared, must be self-reliant, and are personally responsible for their choices and experiences. Nature reigns supreme as natural processes and elements dictate visitation due to flooding, high winds, excessive heat, and lack of a potable water source. The park does not provide visitors with suggested travel plans or destinations, which leaves visitors with a sense of freedom to explore.

From grasslands to badlands, the natural ecosystems set the stage for solitude and unconfined recreation opportunities. With each ridge crested and every valley explored, the story of the wilderness unfolds. The meandering topography, undeveloped views, pristine soundscapes, and dark night skies provide visitors with the opportunity to experience solitude, freedom, and spirituality in a setting that is undisturbed by modern human influences. These experiences are threatened and degraded by encroaching development, activities, and influences from outside park boundaries. Impacts to the solitude or primitive and unconfined types of recreation include degraded viewsheds, soundscapes, and night skies.

Educating visitors about the wilderness areas and encouraging use would provide more people with opportunities to have this type of experience. However, increased visitation to the wilderness areas has the potential to impact resources and visitor experience. It could lead to increased evidence of and damage from human activities including crowding, signs of human waste, cairns, and disturbance to artifacts, petroglyphs, and

petrified woods. Wind-blown trash, air tours, and the broader implication of climate change can also have profound effects on the experience of visitors. It is important to note, conditions are not uniform throughout the north and south wilderness units and some threats are higher in certain sections of the wilderness.

Opportunities to Understand the Wilderness Concept

In an effort to gain visitor feedback for revision of the park general management plan and for development of the Wilderness Stewardship Plan, questionnaires were distributed from February 2001 through January 2002 at the north and south entrances of Petrified Forest National Park. A total of 1,000 questionnaires were distributed, and 80% of respondents returned surveys to designated survey drop boxes. The questionnaire included questions on trip characteristics, visitor activities and locations visited, preferences for management of the park, and visits to the park wilderness units. Pertinent results pertaining to visitors perceptions of and experiences in the wilderness areas have been summarized below (Lee, Hockenberry, and Delost 2002).

- One-third of all visitors to Petrified Forest National Park said they went to one of the two wilderness areas in the park during their visit. However, it was noted by study researchers that this may be an over estimate of wilderness use due to possible confusion among visitors as to the actual location of wilderness boundaries (Lee, Hockenberry, and Delost 2002). Of those visitors, almost all said they went to the Painted Desert Wilderness Area for a day use visit. Only 1% of those that said they went to the Painted Desert Wilderness Area stayed overnight, and 2% of those who said they went to Rainbow Forest Wilderness stayed overnight.
- Of the visitors responding that they went to a wilderness area, 98% went to the Painted Desert Wilderness, and 79% went to the Rainbow Forest Wilderness.
- One-fourth of visitors (25%) said that they were familiar with the national wilderness preservation system, while 54% said they were not familiar, and 21% were not sure.
- Three-fourths of visitors (74%) said they did not know about the wilderness areas in Petrified Forest National Park before they came—54% said they learned about the two wilderness areas during their visit, most commonly from brochures (86%), exhibits (58%), and park staff (30%).
- In response to an open-ended question asking why they visited the wilderness, the most common responses were to see it, sightseeing, and curiosity.
- The Painted Desert and views were two of the most common replies given when asked what the visitors liked most about their wilderness experience. While not enough time and the wind were the most frequent responses in what was least liked about their visit to the wilderness.
- Overall, the quality of visitor wilderness experience was very high—the average rating was 4 on a scale of 1 to 5, with 5 being the best possible rating.

Ability to Access the Wilderness

The only designated access point into park wilderness is at Kachina Point, near the north wilderness area. From Kachina Point, the unpaved Painted Desert Rim Trail extends

about 0.5 mile into the backcountry, winds through the rim woodland, and gives visitors an opportunity to encounter many species of plants and animals and to take in the spectacular view of the Painted Desert. Visitors must hike another 0.5 mile beyond the end of the trail to cross the wilderness boundary. However, as noted in a study conducted by Northern Arizona University, there is often confusion about the exact location of the wilderness boundary as accessed from this point (Lee, Hockenberry, and Delost 2002). Backpackers are currently directed to park at the Painted Desert Inn and hike beyond Lithodendron Wash (1.0 mile from access trailhead) to set up camp.

The south unit of the wilderness area has a different character than the north unit. No trail or signs exist to indicate access into this area. Although there are three undesignated access points into the south wilderness area, visitors are only provided information about these locations upon request. These include an access point near Crystal Forest, the historic route accessed via the main park road, and access via Long Logs Trail.

Visitor Safety

The health and safety of park visitors, staff, and neighbors are of great importance to the National Park Service. Park staff is responsible for maintaining conditions that protect the health and safety of employees and visitors in the park. Statutory and regulatory provisions applicable to national park units require the National Park Service to provide safe facilities, utilities, and grounds within the park and to promote safety in park programs and project operations (NPS *Management Policies 2006*, section 8.2.5). Although safety is of upmost importance, visitors take inherent risks when they enter the wilderness areas. During the summer season, the lack of shade and extreme temperatures can pose risks to hikers if they do not come prepared for this environment. Because there are no signs, no trails, no permanent water sources, and no facilities, visitors must come prepared to be entirely self-reliant. Information about park conditions and safety is provided to visitors through a variety of avenues including the park website, brochures, and communications with park rangers. Incidents rarely occur in the wilderness areas, yet the park is prepared to implement its established search and rescue protocols in the case of an emergency.

PARK OPERATIONS

Petrified Forest National Park is administered by a superintendent and several division chiefs who are responsible for the following seven functional areas: administration, interpretation and education, protection, fee collection, maintenance, resource management, and museum collection management. More information on the various divisions and their responsibilities can be found in the 2004 *General Management Plan Revision*. Operations are managed out of the Painted Desert headquarters area, where most of the 53 FTE employees are located. Because administrative functions are concentrated in the headquarters area, communication between staff is generally good. Emergency response time in the wilderness area is good, with protection staff stationed at both ends of the park. Patrols of the wilderness area are currently performed on an infrequent basis due to the remoteness of the area and general observance of the Wilderness Act.

Developed Areas, Trails, and Roads

There are no developed areas, facilities, trails, or public roads in either of the wilderness areas. In the northern wilderness unit, there is an unimproved administrative two-track road used for boundary fence maintenance. There are two access areas in the north wilderness unit that have previously been disturbed.

Campgrounds

There are no designated campgrounds within either of the wilderness areas. Dispersed camping is currently allowed in only the designated wilderness areas within the park.

SOCIOECONOMIC ENVIRONMENT

For this analysis, the influence area for economic and social consideration associated with the Petrified Forest National Park wilderness areas includes Apache and Navajo counties, including the gateway city of Holbrook that is 27 miles west of the park. The region is largely rural and populated with small towns along the major road network that includes Interstate 40 and U.S. Highway 180. The nearest metropolitan area is Flagstaff, which is less than a 1.5-hour drive west of Holbrook, Arizona. Both Phoenix (Arizona) and Albuquerque (New Mexico) are about 3.5 hours driving time away. A Burlington Northern Santa Fe Railroad line bisects the park and runs south of, and parallel to, Interstate 40. The Navajo and Hopi reservation lands comprise the entire northeast portion of the state and border the park to the north.

The regional economy is largely driven by nonfarm employment and industries. A large portion of the economy is based on government employment and enterprises, transfer payments, and tourism-related industries. Personal incomes are lower than the state as a whole, and unemployment and poverty rates are higher than the state as a whole.

Population

The state of Arizona has had a rapid population growth during the past 20 years, growing 25% from 1990 to 2010. Navajo and Apache counties are no exception, but they have grown more slowly than the state as a whole. Population growth of Navajo County, however, was more than double that of the nation during the same time period.

Navajo County is west of Apache County, covers 9,953 square miles, and had a population of 107,449 as of 2010 (table 9). Navajo County's population is estimated to have grown 10% from 2000 to 2010, and by 38% since 1990 (U.S. Census 2010). Holbrook is the seat of Navajo County and the third most populated community in the county. Holbrook had an estimated population of 5,053 in 2010, representing about 5% of county residents. The largest town in the county is Show Low, with more than 12,000 residents, which is about 70 miles south of the park via Arizona Highway 77 (AZ Dept. of Commerce 2009). About 30% of Navajo County residents live on the White Mountain Apache, Hopi, and Navajo reservations. The projected population of Navajo County in 2025 is 157,000 people (AZ Dept. of Commerce 2009).

Apache County encompasses just over 11,200 square miles and had a population of 69,423 in 2000. The county's population is estimated to have grown by just over 3% from 2000 to 2010, and by 16% since 1990 (U.S. Census 2010). St. Johns is the Apache County seat and was home to 3,973 people in 2007, representing just over 5% of county residents. Eagar is the most populated town in the county, with an estimated 4,810 people in 2008, or just more than 6% of the county population (Arizona Dept. of Commerce 2009). Both St. Johns and Eagar are southeast of the park, about a 1-hour drive and a 1.5-hour drive from Holbrook, respectively. The remaining 89% of the county's population lives in less populated communities, unincorporated areas, or on the White Mountain Apache or Navajo reservations. Apache County is projected to have 90,167 residents by 2025 (AZ Dept. of Commerce 2009).

TABLE 9. POPULATION GROWTH TRENDS, 1990–2010

	1990	2000	2010	Change 1990–2010	% Change 1990–2010
Apache County	61,591	69,423	71,518	9,927	16%
Navajo County	77,658	97,470	107,449	29,791	38%
Arizona	3,665,228	5,130,632	6,392,017	2,726,789	74%
United States	248,709,873	281,421,906	308,745,538	60,036,665	24%

Source: U.S. Census Bureau (Population Finder), 2010

Economic Conditions

Apache and Navajo counties have had an overall increase in employment (number of jobs) since 2005. County employment has increased in Apache County, for example, from a little over 28,000 jobs in 2005 to about 31,000 jobs in 2009, a 10% increase. Navajo County has had less of a trend, with county employment increasing by only 3% during the same time period (table 11). Job growth in Apache and Navajo counties has been increasing, and it is significantly higher than the total employment growth rate in Arizona during the same time period (0.83%), as well as that of the nation as a whole (1%).

Neither Apache County nor Navajo County has a diverse job base. Most jobs and compensation related to those jobs, are nonfarm related, with a substantial portion represented by government employment (table 12). For example, in 2009, total nonfarm compensation for Apache County accounts for 101% of total county compensation, and of that percentage, 67% is a product of the government and government enterprises. Government compensation broken down by level of government is 61% state and local, 38% federal civilian, and 1% military. Compensation, in this case, is the sum of wage and salary disbursements and supplements to wages and salaries, including employer contributions for employee pensions, insurance funds, and government social insurance.

In Navajo County, 99.4% of total county compensation is nonfarm related. Of that percentage, 39% is related to government and government enterprises. Most of this compensation (72%) is at the state and local government level, whereas 26% is federal civilian and 2% is military. In both counties, local governments provided most government compensation (U.S. Bureau of Economic Analysis 2011a).

Apache and Navajo counties had significant increases in per capita personal income between 2005 and 2009. Despite this, the per capita personal income in these counties, Navajo County is the lowest and Apache County is the fourth lowest in the state (table 10). Given the low personal incomes in the region, the regional economy is more reliant on outside dollars to sustain the economy, making the park's ability to draw tourists to the area a critical component of the regional economy.

TABLE 10. PER CAPITA PERSONAL INCOME, 2005–2009

	2005	2009	% Change 2005–2009	% of 2009 U.S.	2009 Statewide Rank (of 15)
Apache County	$20,049	$24,947	24%	37%	12
Navajo County	$19,824	$23,316	18%	41%	15
Arizona	$31,491	$33,207	5%	16%	N/A
United States	$35,424	$39,635	12%	100%	N/A

Source: U.S. Bureau of Economic Analysis. Table CA04, 2011b

In 2009, there were an average of 31,003 people employed and an average of 3,560 people unemployed (15.4%) in Apache County. In comparison, Navajo County had an average of 40,236 people employed and 6,205 unemployed people in 2009, a 15.0% unemployment rate. In comparison, Arizona's average unemployment rate in 2009 was 9.7%—much lower than either Apache or Navajo counties (table 13) (Arizona Dept. of Commerce 2009).

Arizona's statewide annual average unemployment rates are more similar to the national average than either Apache or Navajo counties, and Apache County has consistently had a higher unemployment rate than Navajo County from 2005 to 2010.

TABLE 11. TOTAL COUNTY EMPLOYMENT (NUMBER OF JOBS), 2001 TO 2009

Year		Navajo County
2001	24,996	34,864
2003	26,302	37,157
2005	28,164	39,020
2007	31,189	42,988
2009	31,003	40,236
2001–2009 % Change		+87%

TABLE 12. EMPLOYMENT BY MAJOR CATEGORY, 2009

County	Total Employment	Agriculture	Non-Agriculture	Government[a]
Apache	31,003	14%	45%	42%
Navajo	40,236	8%	66%	26%
Arizona	3,234,719	.83%	85%	14%

Source: U.S. Bureau of Economic Analysis, REIS, Table CA25N, Updated September 2011 (2011a)

a. Includes federal, state, and local government, and military personnel.

TABLE 13. UNEMPLOYMENT RATES, 2005–2010

Area of Interest	Annual Average					
	2005	2006	2007	2008	2009	2010
Apache County	10.5%	9.76%	8.62%	11.1%	15.4%	16.4%
Navajo County	8.1%	7.2%	6.32%	9.67%	15.0%	16.0%
Arizona	4.7%	4.1%	3.8%	5.9%	9.7%	10.0%
United States	5.1%	4.6%	4.6%	5.8%	9.3%	9.6%

Sources: Arizona Dept. of Commerce, Workforce Informer, LAUS Special Unemployment Report (2011); U.S. Bureau of Labor Statistics, 2011

Gateway Community

Holbrook is the main trading and services center for northeast Arizona. Holbrook is along Historic Route 66, is at the junction of four major highways, and is the gateway community to Petrified Forest National Park (AZ Dept. of Commerce 2009). Given that Holbrook is the park gateway community, it provides essential services for park employees and their families living in the city and those that reside in the park. Holbrook also provides most services for visitors and tourists to the park, has 1,082 hotel rooms, 9 meeting rooms, and a municipal airport with general aviation services (AZ Dept. of Commerce 2009).

Tourism-related industries play a significant role in the local economy. In 2009 (most recent data available), accommodation, food services, retail trade, and arts, entertainment, and recreation accounted for 22% of nonfarm employment in Navajo County (U.S. Bureau of Economic Analysis 2011a). Although county employment does not perfectly mirror Holbrook's economy, these sectors of the economy have a substantial effect on Holbrook's economy as a whole.

In addition to Petrified Forest National Park, other attractions draw visitors to the area and contribute to the local economy. Local and area attractions include Canyon de Chelly National Monument; the Hashknife Posse Pony Express Ride; the Holbrook Old West Celebration; Fireman's Barbeque; Navajo County Horse Racing; the Navajo County Fair; and Navajo and Hopi reservation attractions, including ceremonial dances, tribal events, and arts and crafts (AZ Dept. of Commerce 2009).

Economic Contributions of Petrified Forest National Park

The park contributes substantially to the local and regional economy. Park operations, capital expenditures, federal payments in lieu of taxes, and park visitors all play a role.

During the past 10 years, the total annual operating budget of the park has increased by almost 36%, to just over $3.4 million. The annual operating budget, which includes wages and benefits paid to park staff, is the largest share of the total budget. The number of park staff has fluctuated over time, but there are currently 51 FTE employees at the park. In addition, the park often hires members of the community as seasonal staff and in 2011, 46% of park permanent staff were hired locally. The park cooperating association and concessions operators also hire some of their staff from Holbrook and surrounding areas.

Petrified Forest National Park key visitor facilities and much of staff housing are more than 25 miles from nearby communities. Given that the park is so isolated, it is fairly self-sufficient, operating its own wastewater treatment systems, waterlines, water storage tanks, and fire equipment. The park contributes to the regional and tribal economies by purchasing water from the Navajo Tribal Utilities Authority. The park is not, however, entirely self-sufficient and must rely on nearby communities, particularly Holbrook, for some of its employee housing and service needs. About 35 employees live in Holbrook, Joseph City, and Sanders, either in private homes or park-owned housing in Holbrook.

Visitors. In addition to direct economic stimulus in the form of employee and park spending, the park is a major economic driver in the region because of dollars spent by visitors to the park. Visitors spend money sleeping in hotels, eating at restaurants, and purchasing gas and other items while in Holbrook or in the region; a percentage of each dollar remains in the local economy and is spent again (economic multiplier effect), increasing every dollar's overall positive impact.

The number of park visitors changes each year as a result of factors such as overall economic conditions and gas prices. After a steady decline in visitation that began in the mid-1990s, the number of visitors to the park is on

the increase. In 2010, the park had 664,725 visitors. The 543,714 visitors in 2008 were the fewest since 1955 when there were 441,700 visitors (NPS 2011a).

At the end of 2007, the U.S. economy officially entered into a recession (Office of the President 2009). The recession has adversely affected economic and social conditions domestically and abroad, and Apache and Navajo counties are no exception. Nationally, the weakened economy has led to reduced consumer spending. The park has historically had about 500,000 visitors annually, given current and projected economic conditions, this visitation level was expected to decline somewhat in 2009 and 2010 if general economic conditions and trends do not improve. However, visitation actually increased in 2009 and 2010.

Travel Spending. Travel spending affects area employment and the tax base as well as personal income. Total direct travel spending has decreased in Apache and Navaho counties since 2007. In 2010, the most recent figures available, total direct spending in Apache County was $132 million and $270 million in Navajo County (Arizona Office of Tourism 2010). As a result of the current economic downturn, visitation and associated travel spending is expected to decline. This decline could be mitigated by direct marketing in the surrounding area, as well as the nearest major metropolitan areas such as Phoenix and Flagstaff, Arizona, and Albuquerque, New Mexico.

Concessions. The park currently has one concessioner contract with Xanterra Parks and Resorts, LLC (Xanterra) to operate two small retail stores, a gas station, and two small cafeterias in the park. As part of its park operations, Xanterra has developed a solid waste recycling program and a "buy local" framework that reduces environmental degradation and assists local businesses. For example, the food waste generated from the two cafeterias is given to local ranchers to help feed their animals. As a result, in 2006, more than 1,400 pounds were diverted from the landfill. In addition, Xanterra purchases locally grown flour from the Navajo Reservation that is delivered in cloth bags that are returned to the reservation to be reused. Xanterra efforts to recycle and reuse solid waste materials resulted in 76% of solid wastes being kept out of the landfill (NPS 2010).

Museum Association. The Petrified Forest Museum Association was established and approved in 1941 by the Secretary of the Interior. The association is a nonprofit, nongovernmental organization whose principal objective is to aid preservation and interpretation of the park. The association operates three book sales outlets in the park at the Painted Desert visitor center, Painted Desert Inn, and Rainbow Forest Museum. The association also publishes park-specific books for sale and prints free informational materials such as the park newspaper, brochures, flyers, and site bulletins. Proceeds from the sale of publications are used to support educational and interpretive activities and research in the park.

IMPACT TOPICS CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Some resource impact topics that are commonly considered during the planning process were dismissed from detailed analysis because the resource or topic was not applicable or did not occur (or was unlikely to occur) in park wilderness areas or areas of effect. Topics were also dismissed if determined that the anticipated impacts would have no effect, negligible effect, or possibly a minor effect on resources. The following topics were dismissed from detailed analysis.

AIR QUALITY

The 1963 Clean Air Act, as amended (42 USC 7401 et seq.), requires land managers to protect air quality. Section 118 of the Clean Air Act requires parks to meet all state, federal, and local air pollution standards. NPS *Management Policies 2006* addresses the need to analyze potential impacts to air quality during park planning. Petrified Forest National Park is classified as a class I air quality area under the Clean Air Act. The Clean Air Act also states that the federal land manager has an affirmative responsibility to protect park air quality-related values from adverse air pollution impacts.

Regional air quality and visibility would not be affected by the alternative. Air pollution from sources outside the park would be addressed through Clean Air Act authorities and through cooperative efforts between the National Park Service and other entities. Some of these sources include dust from solar and wind energy developments, vehicle emissions from vehicles on Interstate 40, and emissions from local existing and potential new coal-fired power plants. New trail and access point development activities proposed in the action alternative could result in short-term, negligible, localized effects from dust, but these effects would be controlled and mitigated, and no long-term change in air quality would be expected. Air quality was, therefore, dismissed from detailed analysis.

CARBON FOOTPRINT

For the purpose of this planning effort, "carbon footprint" is defined as the sum of all emissions of carbon dioxide and other greenhouse gases (e.g., methane and ozone) that would result from implementation of the action alternative. Understanding the carbon footprint of the action alternative is important to determine its contribution to climate change.

It has been determined that the management alternative described in this document would emit only a negligible amount of greenhouse gases that contribute to climate change; therefore, this impact topic has been dismissed from detailed analysis in this plan. The reasons for dismissing this impact topic are that, (1) no new road or facility construction is proposed under either alternative, and (2) there would be only a small increase in gas consumption from inventory and monitoring efforts under the action alternative. Because of the negligible amount of greenhouse gas emissions that would result from the action alternative, a quantitative measurement of its carbon footprint was determined by the planning team not to be practicable or meaningful.

ECOLOGICALLY CRITICAL AREAS AND WILD AND SCENIC RIVERS

No portions of the park within the wilderness areas have been designated as ecologically critical or have been found to be eligible and suitable for designation as a wild and scenic

river. Therefore, this topic was dismissed from detailed analysis.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

The implementing regulations of the National Environmental Policy Act require that energy requirements, natural or depletable resource requirements, and conservation potential be analyzed.

The NPS *Guiding Principles of Sustainable Design* (1993) provide a basis for achieving sustainability in facility planning and design, emphasizes the importance of biodiversity, and encourages responsible decisions. Sustainability can be described as the result achieved by living in a way that does not compromise the environment or its capacity to provide for present and future generations. The guidebook describes principles to be used in the design and management of visitor facilities that emphasize environmental sensitivity in construction, use of nontoxic materials, resource conservation, recycling, and integration of visitors with natural and cultural settings. Sustainable practices minimize the short- and long-term environmental impacts of developments and other activities through resource conservation, recycling, waste minimization, and the use of energy efficient and ecologically responsible materials and techniques.

Petrified Forest National Park strives to reduce energy costs, eliminate waste, and conserve energy resources by using energy efficient and cost effective technology wherever possible. Energy efficiency would also be incorporated into any decision-making process during the design or acquisition of facilities, as well as all decisions affecting park operations. Value analysis would be used to examine energy, environ-mental, and economic implications of proposed development. The park would encourage suppliers, permittees, and contractors to follow sustainable practices and address sustainable practices in interpretive programs.

This Wilderness Stewardship Plan does not propose any new infrastructure or developments. The new hiking trail and designated camping areas would be carefully sited and use existing trails to the extent possible. Similarly, vehicular routes for administrative use would be unimproved and would use existing roads as much as possible. Thus, under the action alternative, there would be negligible impacts on energy requirements and conservation potential. Therefore this topic was dismissed as an impact topic.

GEOLOGIC RESOURCES

The Chinle Formation is found throughout Petrified Forest National Park. This formation resulted from the rapid deposition of river and lake sediments beginning around 205 million years ago during the Late Triassic period of Earth history. This formation is composed of five geologic layers or strata, including (from oldest to youngest): Mesa Redondo, Blue Mesa, Sonsela, Petrified Forest, and Owl Rock members (NPS 2010).

Various geologic features are found in both wilderness units. The north wilderness unit includes the Painted Desert, Devil's Playground, Pilot Rock, and the Black Forest. The south wilderness unit includes the Rainbow Forest Badlands. Geologic resources in the wilderness areas continue to be shaped by wind and erosion. There are no actions in either of the alternatives that would have adverse effects on geologic resources (not including soils) in the wilderness units. Therefore the topic of geologic resources was dismissed from detailed analysis.

GEOLOGIC HAZARDS

There are no specific geologic hazards such as earthquakes, volcanoes, or landslides in Petrified Forest National Park. None of the actions analyzed in this Wilderness Stewardship Plan would affect geologic hazards. This topic was, therefore, dismissed from detailed analysis.

PRIME AND/OR UNIQUE FARMLANDS

In August 1980, the Council on Environmental Quality directed that federal agencies must assess the effects of their actions on farmland soils classified by the U.S. Natural Resource Conservation Service as prime or unique. Prime farmland is defined as soil that produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. There are no prime or unique farmlands within the park, so this topic was dismissed from detailed analysis.

WATER RESOURCES (INCLUDING WATER QUALITY, WETLANDS, FLOODPLAINS, AND STREAMS)

The wilderness area, specifically the north unit, encompasses portions of the Digger and Lithodendron washes. These washes are ephemeral in nature and provide surface flows only in response to rain and snow melt in the spring and flash flooding during the summer monsoon rains. Surface water is also available seasonally in small pools, springs, and seeps; however, there are no reliable, consistent, water sources in either wilderness unit.

The wilderness area overlays the Coconino Regional Aquifer, also known as the "C Aquifer." The C Aquifer is very deep, underlying much of northeastern Arizona and northwestern New Mexico. In Arizona, the right to use groundwater is tied to property, and there are a number of smaller wells, both within and outside the park that tap this aquifer. The extensive withdrawal of groundwater by two major power generating stations in Joseph City and St. Johns is a concern to the long-term supply of water from the C Aquifer to meet the future needs of visitor services, fire suppression, and other park operations (NPS 2003b).
Executive Order 11990, "Protection of Wetlands," requires federal agencies to avoid, where possible, impacts on wetlands. Wetland areas within Petrified Forest National Park are few and are generally associated with rivers or washes. The wilderness area and specific actions associated with each alternative have been evaluated with regard to potential effects on wetlands. A new trail could cross or be sited near Lithodendron Wash, which would not adversely affect wetlands. Potential areas proposed for the new trail would be carefully evaluated before any ground-disturbing activities are initiated to ensure that wetland impacts are avoided.

Executive Order 11988, "Floodplain Management," requires federal agencies to avoid construction within floodplains unless no other practical alternative exists. A new trail would be constructed in or near Lithodendron Wash and floodplain in the action alternative, but foot trails constructed outside high hazard areas are excepted actions (NPS 2003a). No other actions proposed in the action alternative would be within the regulatory floodplain. Flood conditions tend to limit access across washes because bridges do not exist. These conditions can persist for weeks after heavy rains because of adverse soil conditions in the washes, including quicksand.

The 1972 Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977, is a national policy to restore and maintain the chemical, physical, and biological integrity of U.S. waters; to enhance the quality of water resources; and to prevent, control, and abate water pollution. NPS *Management Policies 2006* provides direction for the preservation, use, and quality of water in national parks. Impacts to water quality from implementation of the alternatives in this plan would generally be avoided; potential impacts would be minimized or avoided by using best management practices and other mitigation measures.

Climate change could influence the future condition of water resources in wilderness areas. Additional precipitation, especially snow during the winter, could increase the recharge rate of regional aquifers and increase the availability of water found in small natural

pools, springs, seeps, and riparian wetlands throughout the wilderness areas. However, prolonged periods of drought are also anticipated, which could lead to the periodic scarcity of these water resources.

There would be no impacts from the alternatives to wetlands, floodplains, or water quality, therefore, water resources were dismissed from detailed analysis.

FEDERAL AND STATE LISTED SPECIES (INCLUDING THREATENED AND ENDANGERED SPECIES)

The Endangered Species Act of 1973, as amended, requires that federal agencies consult with the U.S. Fish and Wildlife Service before taking any action that could jeopardize the continued existence of any federally listed threatened or endangered plant or animal (vertebrate or invertebrate) species. Agencies must consider potential effects the proposed action may have on the species. NPS policy also requires the examination of impacts on federal candidate species, as well as state listed threatened, endangered, candidate, rare, declining, and sensitive species.

In a letter dated August 31, 2011, the U.S. Fish and Wildlife Service provided information about federally listed species that may potentially exist in Apache and Navajo counties. The Arizona Game and Fish Department, through the Arizona Natural Heritage Program, was consulted to provide input on state listed species that may live in the wilderness areas. No comprehensive inventories have been conducted in the wilderness areas to verify the presence of any of these listed species.

Table 14 provides a listing of federal and state listed species that may inhabit park wilderness areas, based on information provided by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department. These determinations are based on special status species known to live in the park. The list includes species known to occur in the park, those that may winter in the area (peregrine falcon), those that have likely been extirpated (black-footed ferret), and those that have been reintroduced (gray wolf, California condor). This list does not include species identified by the U.S. Fish and Wildlife Service or Arizona Department of Game and Fish whose habitat is not supported in the wilderness areas such as the five special status fish species identified by the U.S. Fish and Wildlife Service because of the lack of suitable stream habitat found in park wilderness areas.

The topic of threatened and endangered species and species of special concern was dismissed as an impact topic due to, (1) none of the federally listed threatened or endangered species have been observed in any of the areas proposed for trail or access point development (and dispersed camping) in the action alternative; (2) no critical habitat for federally listed threatened or endangered species or species of special concern has been identified; and (3) suitable habitat for migrating birds is found throughout the park and escape cover is available elsewhere; therefore, migrating birds would not be adversely affected by the activities proposed in the alternatives. It is unknown if these species use resources within park wilderness areas for habitat or forage; however, the action alternative would seek to better protect these species, resulting in beneficial effects.

Inventory and monitoring for the presence of threatened and endangered species will continue. If threatened and endangered or species of special concern are sited and documented in the wilderness area in the future, the park will ensure appropriate management actions, as necessary, in compliance with the Endangered Species Act.

TABLE 14. FEDERAL AND STATE LISTED SPECIES THAT MAY EXIST IN THE PARK WILDERNESS UNITS

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Black-footed ferret	*Mustela nigripes*	E	WSC	Grassland plains, generally found in association with prairie dogs	H
Mexican gray wolf	*Canis lupus baileyi*	E	WSC	Chaparral, woodland, and forested areas – may travel through desert areas	H
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	C		Dry soils for nesting; uses moist, streamside, dense riparian/wetland vegetation (persistent emergent herbaceous wetlands and scrub-shrub wetlands)	U
American peregrine falcon	*Falco peregrinus anatum*	R		Grasslands, shrub-steppe, deserts, and other open areas	U
California condor	*Gymnops californianus*	E	WSC	High desert canyon lands and plateaus	H
Mexican spotted owl	*Strix occidentalis lucida*	T	WSC	Nests in canyons and dense forests with multilayered canopies	H
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	WSC	Cottonwood/willow and tamarisk vegetation communities along rivers and streams	H
Yellow-billed cuckoo	*Coccyzus americanus*	C	WSC	Large blocks of riparian woodlands (cottonwoods, willow, or tamarisk galleries)	H
Chiricahua leopard frog	*Rana chiricahuensis*	T	WSC	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs	U
Northern Mexican gartersnake	*Thamnophis eques megalops*	C		Dense riparian vegetation and woodlands, and wetland shallows	U

TABLE 14. FEDERAL AND STATE LISTED SPECIES THAT MAY EXIST IN THE PARK WILDERNESS UNITS

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Gladiator milkvetch	*Astragalus xiphoides*	SC	SR	Grasslands and alluvial plains on Chinle and Moenkopi formations, associated with badlands of broken sandstone and clay bluffs, in washes, in floodplains, or in complexes of small arroyos	S/U
Navajo sedge	*Carex specuicola*	T	HS	Silty soils at shady seeps and springs	S/U
Paper-spined cactus	*Pediocactus papyracanthus*	SC	SR	Open flats in grasslands and pinyon-juniper woodlands associated with grama grass	S/U
Peebles Navajo cactus	*Pediocactus peeblesianus var. peeblesianus*	E	HS	Gravely soils of the Shinarump conglomerate of the Chinle Formation	S/U
Zuni fleabane	*Erigeron rhizomatus*	T	N/A	Selenium-rich red or gray detrital clay soils derived from the Chinle and Baca formations	S/U

Source: USFWS 2011

The U.S. Fish and Wildlife Service and the Arizona Game and Fish Department use the following categories to track the special status of species that are included in table 14.

Federal Status

- E Listed Endangered – imminent jeopardy of extinction
- T Listed Threatened – imminent jeopardy of becoming endangered
- C Candidate – has sufficient biological vulnerability and threats to support proposals for listing
- SC Species of Concern – conservation status may be of concern to the U.S. Fish and Wildlife Service
- R Recovery – species is no longer considered threatened or endangered, or threats to its survival are neutralized

Arizona State Status

- HS Highly Safeguarded – no collection allowed
- SR Salvage Restricted – collection only with permit
- WSC Wildlife of Special Concern – species whose occurrence in Arizona is or may be in jeopardy

In addition to their federal and state status, each species has also been classified according to the likelihood of their presence within the park wilderness area. These categories include:

D Documented – the species is known to live in the wilderness areas
S Suspected – the species may live in the wilderness areas based on the availability of suitable habitat within the wilderness areas
H Historic – the species likely lived historically in the park wilderness areas, but is no longer found there
U Unknown – historical evidence does not indicate the species lived in the park wilderness areas and given the lack of resources such as a consistent water supply, it is unlikely the species currently exists in the wilderness areas other than possibly migrating through them from adjacent parklands outside the park boundary; the species has not been found in any park surveys

HISTORIC BUILDINGS AND STRUCTURES

Historic buildings and structures of Petrified Forest National Park include the Painted Desert Inn at the edge of the Painted Desert. The Pueblo Revival structure (originally constructed in 1924 and rebuilt between 1937 and 1940) is designated a national historic landmark. It is used primarily today for visitor information and orientation, book sales, and limited exhibit displays. The Painted Desert headquarters complex has been evaluated as eligible for the national register because of its construction during the NPS Mission 66 initiative and its associations with that national program of park improvements. These properties and other historic structures in the park (e.g., those contributing to the significance of the Rainbow Forest Historic Landscape) are managed in accordance with NPS policies and the *Secretary of the Interior's Standards for the Treatment of Historic Properties* to preserve and protect their architectural and historical character. Standing historic buildings and structures have not been identified by cultural resource surveys of the park's wilderness areas, although there is a potential for the collapsed remains of former structures (e.g., Navajo hogans) to be identified by future surveys. These structural remains could retain informational potential as historic archeological sites. Actions proposed by the present plan are not anticipated to affect or alter the management of the park's documented historic buildings and structures or the remains of structures that may exist in wilderness areas. Therefore, the topic of historic buildings and structures was dismissed from detailed analysis in this plan.

Relevant Law, Regulation, or Policy

Sections 106 and 110 of the National Historic Preservation Act; ACHP implementing regulations regarding "Protection of Historic Properties" (36 CFR 800); NPS-28: *Cultural Resources Management Guideline*; the *Secretary of the Interior's Standards for the Treatment of Historic Properties;* NPS *Management Policies 2006;* and the National Environmental Policy Act

CULTURAL LANDSCAPES

By NPS definition, a cultural landscape is

> *a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions* (NPS-28).

The Rainbow Forest area, constructed primarily by the Civilian Conservation Corps during the 1930s, served as the original visitor contact area and headquarters for the park.

The developed area was determined eligible for inclusion in the national register as a historic designed landscape. The Crystal Forest developed area was also determined national register-eligible as an historic designed landscape. Historic landscapes are managed in accordance with NPS policies and the *Secretary of the Interior's Standards for the Treatment of Historic Properties (with Guidelines for the Treatment of Cultural Landscapes)* to preserve and protect character-defining features (e.g., vegetation, contributing buildings, spatial relationships, and patterns of circulation). The park's designated cultural landscapes are outside the wilderness areas and will not be affected by actions proposed by the Wilderness Stewardship Plan.

Although no formal ethnographic landscape studies have been undertaken in the park (NPS 2004), the long-standing cultural connections to the area by contemporary tribes (discussed above under ethnographic resources) strongly suggest that much of the park, including wilderness areas, could be considered and evaluated within the context of ethnographic landscapes. Discussion of potential ethnographic landscapes is included under the topic of "Ethnographic Resources" in this plan.

Actions proposed by the Wilderness Stewardship Plan would neither affect the park's designated cultural landscapes, nor alter or diminish character-defining features, resources, and patterns of traditional use contributing to potential ethnographic landscapes in the park's wilderness areas. Therefore, the topic of cultural landscapes was dismissed from detailed analysis in this plan.

Relevant Law, Regulation, or Policy

Sections 106 and 110 of the National Historic Preservation Act; ACHP implementing regulations regarding "Protection of Historic Properties" (36 CFR 800); NPS-28: *Cultural Resources Management Guideline*; the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes;* NPS *Management Policies 2006;* National Environmental Policy Act

MUSEUM COLLECTIONS

The park's museum collections contains approximately 303,282 cataloged items consisting primarily of paleontological and other natural history specimens, and archeological, historical, and ethnographic objects. On-site collections are housed in the administration building at the Painted Desert headquarters complex. A large number of uncataloged items (particularly paleontological and archeological items) are stored off-site in facilities of the NPS Western Archeological and Conservation Center, the Museum of Northern Arizona, and the Museum of Paleontology at the University of California, Berkeley (NPS 2004). Archeological collections are curated in accordance with the provisions of 36 CFR 79.

Actions proposed by the present Wilderness Stewardship Plan are not anticipated to affect the management of park museum collections, nor substantially contribute to the collection of additional specimens and artifacts requiring expanded or enhanced curatorial storage. Therefore, the topic of museum collections was dismissed from detailed analysis in this plan.

Relevant Law, Regulation, or Policy

National Historic Preservation Act of 1966; NPS-28: *Cultural Resources Management Guideline*; Native American Graves Protection and Repatriation Act of 1990; NPS *Management Policies 2006*; National Environmental Policy Act; Director's Order 24: *Standards for NPS Museum Collections Management*; NPS *Museum Handbook; 36 CFR 79 (Curation of Federally Owned and Administered Archaeological Collections).*

INDIAN TRUST RESOURCES

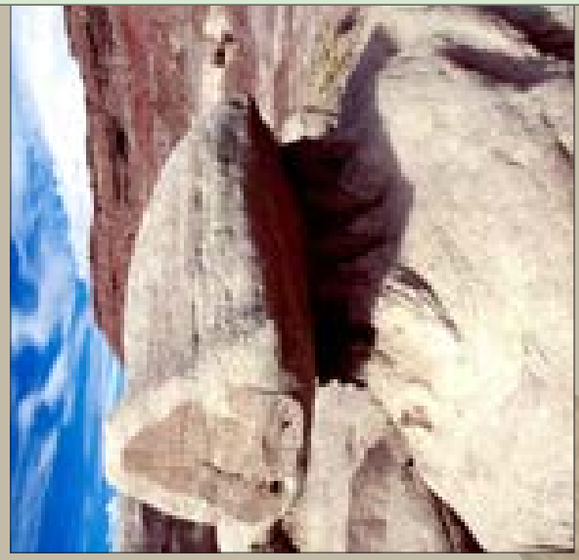
Secretarial Order 3175 requires that any anticipated impacts on Indian trust resources from a proposed project or action by Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.

There are no Indian trust resource within Petrified Forest National Park, including its wilderness units and new addition lands. The lands comprising the park are not held in trust by the Secretary of the Interior for the benefit of Indians because of their status as Indians. Therefore, the topic of Indian trust resources was dismissed from detailed analysis in this plan.

ENVIRONMENTAL JUSTICE

Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-income Populations" requires federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Navajo and Apache counties have both minority and low-income populations and communities. However, environmental justice was dismissed from detailed analysis in this plan for the following reasons:

- The planning team actively solicited public comments and consulted with traditionally associated tribes as part of the planning process. Equal consideration was given to the input from all persons regardless of age, race, ethnicity, income status, or other socioeconomic or demographic factors.
- The action alternative would not result in any disproportionate adverse impacts on minorities or low-income populations and communities. The socioeconomic analysis prepared for this plan indicates that the socioeconomic effects of the action alternative would be beneficial.



INTRODUCTION

The National Environmental Policy Act of 1969 (40 CFR 1500–1508) mandates that environmental assessments disclose the environmental impacts of proposed federal actions. In this case, the proposed federal action is implementation of the Wilderness Stewardship Plan for Petrified Forest National Park. As previously noted in chapter 2, two alternatives have been carried forward for analysis in this plan: the no-action alternative (alternative A) and one action alternative (alternative B). Alternative B has been identified as the agency's preferred alternative, providing a comprehensive strategy for guiding the preservation, management, and use of park wilderness areas in a manner that preserves them unimpaired for future use and enjoyment. Consistent with the provisions of the National Environmental Policy Act, NPS managers will determine if more detailed planning, environmental compliance, and/or other documentation (e.g., additional MRDGs) are required before undertaking specific actions that may arise from implementation of the approved Wilderness Stewardship Plan.

The first sections of this chapter discuss terms and assumptions and the cumulative scenario used in discussions of impacts. The impacts of the no-action alternative and the action alternative are discussed next. Each impact topic includes a description of the impacts of the alternative, a discussion of cumulative effects, and a conclusion. The impact analysis for the no-action alternative assesses the foreseeable continuation of current management practices under existing laws and policies. The impacts of the action alternative describe the difference between implementing the no-action alternative and implementing the action alternative. To understand the consequences of the action alternative, the reader must consider what would happen if no action were taken (i.e., consider the no-action alternative).

Because the five qualities of wilderness character overlap with other impact topics, they have been incorporated accordingly. The natural quality of wilderness has been integrated with the natural resource impact topics. Solitude or a primitive and unconfined type of recreation quality has been incorporated into the visitor use and experience impact topic, and other features and values have been incorporated into the natural resources section (paleontological resources) and the cultural resources section (archeological resources). Impacts to the untrammeled and undeveloped qualities of wilderness are most directly related to maintenance of the boundary fence and excavation or removal of paleontological resources; therefore, more detailed information regarding these qualities is in the programmatic Minimum Requirements Decision Guides (appendix D).

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

Each impact topic includes a discussion of impacts, including the intensity, duration, and type of impact. Intensity of impact describes the degree, level, or strength of an impact as negligible, minor, moderate, or major. Because definitions of intensity vary by resource topic, separate intensity definitions are provided for each impact topic. Duration of impact considers whether the impact would occur over the short term or long term. Unless otherwise noted, short-term impacts are those that, within a short period of time (generally less than five years) would no longer be detectable as the resource or value returns to its predisturbance condition or appearance. Long-term impacts refer to a change in a resource or value that is expected to persist for five or more years. The type of impact refers to whether the impact on the resource

or value would be beneficial (positive) or adverse (negative).

CLIMATE CHANGE

The impacts of climate change on the wilderness units are not expected to vary by alternatives, and the uncertainties associated with the present level of qualitative information regarding the potential effects of climate change in Arizona adds to the difficulty of predicting how these impacts will be realized. The potential influences of these changes on particular park resources were included in "Chapter 3: Affected Environment," but will not be analyzed in detail with respect to each alternative.

CUMULATIVE IMPACTS

The Council on Environmental Quality, which ensures that federal agencies meet their obligations under the National Environmental Policy Act, requires an assessment of cumulative impacts in the decision-making process for all federal projects. Cumulative impacts are described in CEQ regulation 1508.7 as follows:

Cumulative impacts are the impacts that result from the incremental impacts 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. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time.

Cumulative impacts are evaluated separately for the no-action and action alternatives by adding the impacts of each alternative with the impacts of other past, present, and reasonably foreseeable future actions. To determine this, it was necessary to identify other actions adjacent to the Petrified Forest National Park Wilderness Area. Collectively, these other actions are referred to as the cumulative scenario.

Past, present, and reasonably foreseeable future actions have been organized into two main categories: (1) NPS-management actions and (2) other non-NPS management actions. A summary of these actions that could contribute to cumulative impacts is provided for each category. The evaluation of cumulative impacts, described under each impact topic, is qualitative in nature.

NPS Management Actions

The primary NPS-management action that could contribute to cumulative impacts on wilderness resources and values is the ongoing acquisition of properties within the expanded boundary of the park. Since the Petrified Forest National Park Expansion Act of 2004, the National Park Service has been gradually purchasing adjacent lands from willing sellers that have globally significant paleontological resources and nationally significant archeological resources. Over time, it is reasonable to foresee that the majority of lands within the expanded boundary will be in NPS ownership, creating a protective buffer along the western boundary of the north wilderness unit and eastern boundary of the south wilderness unit. However, as noted below, there is also the possibility that non-NPS lands within the expanded boundary of the park may be used for potash mining.

Non-NPS Management Actions

The following non-NPS actions are among those that could contribute to cumulative impacts on wilderness resources and values:

Potash Exploration and Mining. Petrified Forest National Park overlies a rich potash deposit, which is the subject of a 2008 report by the Arizona Geological Survey (Open File Report OFR 08-07, referenced in NPS 2008). The report concluded the following:

Growing global demand for potash for use in fertilizers makes the Arizona Holbrook basin deposit more economically viable and

attractive than previously recognized. The size of the resource . . . is many times larger than fragmentary reports have indicated.

Potash exploration is currently underway on non-NPS lands within the expanded boundary of the park, and there is reason to believe that potash mining could occur in the near future. A publicly traded company announced in 2008 that it had entered into a mineral option agreement with a private company incorporated in Arizona to acquire a 100% interest in 13 state leases in Navajo County (comprising 8,413 acres). A second company reported that it applied for and received 15 state exploration leases on lands covering 9,594 acres in Apache County. In late 2009, Passport Metal, Inc., signed a four-year lease with an option to purchase Twin Butte Ranch for potash mining. This ranch extends across most of the southwestern portion of park expansion lands.

Wind and Solar Energy Development. A commercial-scale wind energy project, referred to as the Dry Lake Wild Project, 18 miles southwest of Holbrook, Arizona, has recently been constructed. Another company has proposed the construction of a large wind energy installation about 9 miles west of the northern wilderness unit. A viewshed analysis conducted by the National Park Service concluded that these energy developments have the potential to contribute to cumulative viewshed impacts on a large portion of park wilderness.

Other Uses and Developments. Due to the vast, open landscape that surrounds Petrified Forest National Park, adjacent uses and developments have a high potential to contribute to cumulative impacts on wilderness resources and values. This is especially true of uses and developments that are highly visible during the day, emit light pollution at night, or emit sounds that carry long distances. Examples of existing uses and developments include communication towers along Interstate 40, an algae bio-science production facility west of the park, coal-fired power plants, noise from vehicles on the interstate and trains on the Burlington Northern Santa Fe Railway, overflights and air tours, and other scattered residential and commercial developments. Furthermore, the Navajo Nation is considering development of a casino, hotel, campground, and truck stop at the Pinta exit south of Interstate 40 on an escarpment east of the north wilderness unit.

IMPACTS ON NATURAL RESOURCES

INTRODUCTION

This section analyzes the environmental consequences of the no-action and action alternatives on the natural resource components of the wilderness area. It is based on the professional judgment of park staff, NPS planners, and other specialists in the field of natural resource management. To provide a thorough analysis of these effects, this section has been organized by the impact topics listed below, which correspond to the natural resource topics described in "Chapter 3: Affected Environment." Similar topics have been grouped together to limit redundancy and to concisely present the analysis.

- Soils
- Paleontological Resources, including Petrified Wood and Other Fossils
- Vegetation and Wildlife

In this Wilderness Stewardship Plan, impacts to natural resources are described in terms of type, context, duration, and intensity, which is consistent with CEQ regulations that implement the National Environmental Policy Act. Impact intensity thresholds have been provided to characterize the adverse and beneficial impacts of actions on natural resources.

Duration

Short-term: Effects that would be temporary, lasting a year or less.

Long-term: Effects that would last more than one year and could be permanent.

Context

Localized Impacts: Effects would occur in areas within the boundaries of the wilderness areas.

Regional or Parkwide Impacts: Effects would occur to other areas outside the wilderness areas of Petrified Forest National Park or in areas of natural significance beyond the park boundary.

SOILS

Methods and Assumptions for Analyzing Impacts

The effects of the management alternatives on soils of the wilderness areas are analyzed based on impacts resulting from land uses, levels of development, and limited visitor use associated with each alternative. Impacts on soils also affect the natural quality of wilderness character. Impacts on soils were evaluated by comparing projected changes resulting from the action alternative to those of the no-action alternative. The thresholds to determine the intensity of impacts are described as follows:

Negligible. The impact is barely detectable and/or would result in no measurable or perceptible changes to soils.

Minor. The impact is slight but detectable, and/or would result in small but measurable changes to soils; the effect would be localized.

Moderate. The impact is readily apparent and/or would result in easily detectable changes to soils; the effects would be localized.

Major. The impact is severely adverse or exceptionally beneficial and/or would result in appreciable changes to soils; the effect would be regional in scale.

Alternative A (No Action)

Under the no-action alternative, soils of park wilderness areas would continue to be trampled and compacted by visitors randomly wandering through the backcountry without a designated trail, signs, and the continuation of dispersed camping where soil coverage consists mainly of sensitive biological soil crusts. The impact of this action on soils in the backcountry would be minor to moderate, long term, and adverse due to soil trampling and compaction from visitor use.

Under this alternative, visitors would continue to be informed on how to properly utilize the wilderness areas so as to minimize the amount of trampling and compaction of biological soil crusts. Also, current wilderness regulations, such as visitor use limits, the number of horses, no open campfires, and camping restrictions, would continue to be in place. These actions would have negligible to minor, long-term, beneficial impacts on soils in the wilderness areas due to limiting the uses that would remove or compact soils, especially sensitive biological soil crusts.

Under alternative A, current park operations would continue. Current park operations offer limited training, education, or protocols in how to properly conduct operations in wilderness, including boundary fence maintenance, scientific research, and waste management. Without specific protocols, training, and guidance, soils are more likely to be removed, trampled, or compacted. Also, emergency responses would continue to be on horseback or by foot to carry out injured or sick visitors from the wilderness. Emergency response would be consistent with the park emergency response plan. Conducting emergency responses with the use of horses or by foot could cause further trampling and compaction of biological soil crusts. Lastly, partnership and public outreach efforts about the value of park wilderness areas would continue to be limited, which does not raise the awareness of visitors about the importance of protecting sensitive wilderness soils. Collectively, these actions would have a negligible to minor, long-term, adverse impact on wilderness soils due to trampling and compaction of soils, particularly of sensitive biological soil crusts.

Cumulative Impacts. Potential future potash mining and residential and commercial development would have potential regional effects on soils due to removal and compaction. Impacts of the above actions, combined with the impacts of the no-action alternative, would result in long-term, minor, adverse cumulative effects on wilderness area soils. The contribution of the no-action alternative to this cumulative effect would be slight.

Conclusion. The no-action alternative would result in long-term, minor to moderate, adverse impacts and long-term, negligible to minor, beneficial impacts on soils in the wilderness units. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. The contribution of the no-action alternative to the effects would be slight.

Alternative B (NPS Preferred Alternative)

Under alternative B, the soils in park wilderness areas would continue to be trampled and compacted by visitors randomly wandering through the backcountry without signs and with the continuation of dispersed camping where soil coverage consists mainly of sensitive biological soil crusts. Also, under this alternative, a new camping zone would be assigned in an area where camping has not been allowed previously. The designated zone will concentrate camping in one area, which is much smaller than the north wilderness unit and would have more frequent repeated use as opposed to the dispersed camping allowed throughout the north wilderness unit in alternative A. The impact of this action on soils in the backcountry would be minor to moderate, long term, and adverse due to soil

trampling and compaction, especially of sensitive biological soil crusts.

Under this alternative, a trail would be developed through the backcountry area in an effort to keep the impacts on biological soil crusts more localized and confined to the trail rather than spread out across the backcountry. This would have minor to moderate, long-term, beneficial impacts to backcountry soils by reducing the amount of trampling and compaction, particularly of sensitive biological soil crusts. However, the trail development would require removal or compaction of biological soils although the trail would be developed in a previously disturbed area, which would have minor, long-term, adverse impacts on biological soil crusts in a localized area.

The development of the new formalized access points in alternative B would have negligible to minor, long-term, adverse impacts to soils due to compaction and/or removal of topsoil during construction. The impacts would be localized and would be within the footprint of currently disturbed areas in these locations—Devil's Playground and Tiponi Point. The new, formalized access points would have negligible to minor, long-term, beneficial impacts on soils by promoting access to the wilderness units through only these points, thus concentrating impacts to soils in local, formalized, and previously disturbed areas.

Under alternative B, park staff would work to better inform visitors through the use of greater methods of public outreach and communication and the use of partnerships than in alternative A, on the value of park wilderness areas and how to properly utilize the wilderness area so as to minimize adverse impacts on soils. Also, current wilderness regulations, such as visitor use limits, the number of horses, no open campfires, and camping restrictions, would continue to be in place and a human waste management strategy would be implemented. The implementation of a proactive monitoring framework under alternative B would track natural resource conditions, and if standards are exceeded, specific management strategies would be implemented to protect resources while still providing appropriate opportunities for solitude and primitive/unconfined recreation. Collectively, these actions would have a minor to moderate, long-term, beneficial impact on wilderness soils due to improved protection from removal, trampling, and compaction.

Under alternative B, changes in park operations would have negligible to minor, long-term, beneficial impacts on soils due to reducing the amount of soil removal, trampling, and compaction. Some of these changes include implementing training, education, or protocols in how to properly conduct operations in wilderness, including boundary fence maintenance, scientific research, and waste management, would help protect wilderness soils due to staff knowing how to conduct operations in the wilderness area in ways and using methods that are appropriate in upholding wilderness values such as using nonmotorized or mechanized transport and tools and avoiding sensitive resources such as biological soil crusts.

As in the no-action alternative, emergency responses would continue to be on horseback or by foot to carry out injured or sick visitors from the wilderness. Emergency response would be consistent with the park emergency response plan. Conducting emergency responses with the use of horses or by foot could also cause further trampling and compaction of biological soil crusts. These actions would have negligible to minor, long-term, adverse impacts on soils due to trampling, compaction, and removal.

Cumulative Impacts. Potential future potash mining and residential and commercial development would have the potential for regional effects on soils caused by removal, trampling, and compaction. Impacts of the above actions, combined with the impacts of the preferred alternative, would result in long-term, minor, adverse cumulative effects on wilderness area soils. The contribution of

alternative B to this cumulative effect would be slight.

Conclusion. The action alternative would result in long-term, minor to moderate, adverse as well as negligible to minor, long-term beneficial impacts on soils in park wilderness areas. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. This alternative's contributions to these effects would be slight.

PALEONTOLOGICAL RESOURCES (INCLUDING PETRIFIED WOOD AND OTHER FOSSILS)

Methods and Assumptions for Analyzing Impacts

The effects of the management alternatives on paleontological resources of the wilderness area are analyzed based on impacts resulting from land uses, levels of development, and limited visitor use associated with each alternative. Impacts on paleontological resources also affect the "other features and values" quality of wilderness character. Impacts on petrified wood and other fossils were evaluated by comparing projected changes resulting from the actions proposed in the action alternative to those of the no-action alternative. The thresholds to determine the intensity of impacts are described as follows:

Negligible: The impact to a site with concentrations of petrified wood or a fossiliferous (potentially contains fossils) layer is at its lowest levels of detection—barely perceptible and not measureable.

Minor: The impact to a site with concentrations of petrified wood or a fossiliferous layer is slight but detectable, or the impact to a site (one with dense concentrations or special kinds of petrified wood or other fossils) is barely perceptible and difficult to measure.

Moderate: The impact to a site with concentrations of petrified wood or other fossils is apparent, or the impact to a site (one with dense concentrations or special kinds of petrified wood or other fossils) is detectable.

Major: The impact to a site with concentrations of petrified wood or other fossils is severe or of exceptional benefit, or the impact to a site (one with dense concentrations or special kinds of petrified wood or other fossils) is readily apparent.

Alternative A (No Action)

Under the no-action alternative, the continued inventorying, monitoring, documentation, and, in some cases, removal of paleontological items from wilderness helps prioritize the paleontological sites for collection and curation in an effort to protect them from weathering, deterioration, and theft. Also, visitors would be informed on how to properly use the wilderness area so as to minimize adverse impacts on paleontological resources such as in not removing petrified wood or other fossils. This alternative would continue to implement current wilderness regulations such as visitor use limits, the number of horses, no open campfires, and camping restrictions. Collectively, the actions would have negligible to minor, long-term, beneficial impacts on paleontological resources in wilderness areas by limiting uses that could remove, displace, or damage these resources; and the removal of paleontological resources provides greater protection from loss due to weathering and deterioration.

Under this alternative, there are currently no established protocols for administrative removal of paleontological items from the

wilderness units. This would have minor to moderate, long-term, adverse impacts on paleontological resources due to the extensive methods often required to remove these items from a wilderness area to a facility where they would be stored and protected. These methods include plaster casts that are extremely heavy and either need to be hauled out on a vehicle, by helicopter, or walked out by many people carrying or dragging it, which raises the possibility of the item being damaged in the process or damaging other intact paleontological resources.

Under alternative A, current park operations would continue. Current park operations offer limited training, education, or protocols in how to properly conduct operations in wilderness, including boundary fence maintenance, scientific research, and waste management. Without specific protocols, training, and guidance, paleontological resources are more likely to be exposed and weathered, damaged, displaced, or removed. Also, emergency responses would continue to be on horseback or by foot to carry out injured or sick visitors from the wilderness area. Emergency response would be consistent with the park emergency response plan. Conducting emergency responses with the use of horses or by foot could also expose, displace, or damage paleontological resources. Lastly, partnership and public outreach efforts regarding the value of park wilderness areas would continue to be limited, which does not help raise awareness to visitors of the importance of the protection of the paleontological resources. Collectively, these actions would have a negligible to minor, long-term, adverse impact on wilderness soils due to the potential for removal, displacement, or damage of paleontological resources.

Cumulative Impacts. Potential future potash mining and residential and commercial development may have potential regional effects on paleontological resources as it may diminish portions of the fossil record in this area. Impacts of the above actions, combined with the impacts of the no-action alternative, would result in long-term, minor, adverse cumulative effects on paleontological resources. The no-action alternative's contribution to this cumulative effect would be slight.

Conclusion. The no-action alternative would result in long-term, minor to moderate, adverse impacts and long-term, negligible to minor, beneficial impacts on paleontological resources in wilderness areas. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. This alternative's contribution to these effects would be slight.

Alternative B (NPS Preferred Alternative)

Under alternative B, inventorying, monitoring, documentation, and, in some cases, removal of paleontological items from wilderness areas would help prioritize paleontological sites for collection and curation to protect them from weathering, deterioration, and theft. Also, the implementation of a proactive monitoring framework for paleontological resources would track their conditions and if standards are exceeded, specific management strategies would be implemented. Changes to park operations would include implementing training, education, or protocols in how to properly conduct operations in wilderness, including boundary fence maintenance, scientific research, and waste management. Park staff would be instructed in the appropriate use of nonmotorized or mechanized transport and tools, and avoidance of paleontological resources as much as possible. Collectively, these actions would have long-term, negligible to minor, beneficial impacts on paleontological resources in wilderness areas due to a reduction in the amount of removal, displacement, and damage from use; and loss from weathering and deterioration of paleontological resources.

Under this alternative, establishment of protocols and adherence to programmatic MRDGs for paleontological research and monitoring in wilderness would further protect paleontological resources. Visitors would be better informed through the use of greater methods of outreach and communication than in alternative A, on how to properly utilize the wilderness area so as to minimize adverse impacts on paleontological resources. Increased partnerships and public outreach efforts regarding the value of park wilderness areas may help facilitate protection of paleontological resources by educating visitors to not remove these resources and to report if they witness other visitors removing resources. Collectively, these actions would have long-term, minor to moderate, beneficial impacts on paleontological resources due to reducing the amount of removal, displacement, and damage from use.

Cumulative Impacts. Potential future potash mining and residential and commercial development may have potential regional effects on paleontological resources as it may diminish portions of the fossil record in this area. Impacts of the above actions, combined with the impacts of the action alternative, would result in long-term, minor, adverse cumulative effects on paleontological resources. The action alternative's contribution to this cumulative effect would be slight.

Conclusion. The action alternative would result in long-term, minor to moderate, beneficial impacts on paleontological resources in park wilderness units. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, minor, adverse and long-term, minor to moderate, beneficial cumulative effects. This alternative's contributions to these effects would be slight.

VEGETATION AND WILDLIFE

Methods and Assumptions for Analyzing Impacts

Vegetation and wildlife are addressed together in this section because an analysis of potential impacts on wildlife typically involves a discussion of wildlife habitat, which consists of the various vegetation communities found within the wilderness areas. The discussion of wildlife in this section includes pronghorn. Impacts on vegetation and wildlife also affect the natural quality of wilderness character. Impacts were evaluated by comparing projected changes resulting from alternative B to those of the no-action alternative. The thresholds used to determine impacts on these resources are described as follows:

Negligible: There would be no observable or measurable impacts on native species, their habitats, or the natural processes sustaining them. Any effects would be well within natural fluctuations.

Minor: Impacts would be detectable, but they would not be expected to be outside the natural range of variability or have any lasting effects on native species, their habitats, or the natural processes sustaining them. Population numbers, genetic variability, and other demographic factors for species might have small changes, but they would remain stable and viable. Occasional responses to disturbance by some individuals could be expected. Sufficient habitat would remain functional to maintain viability of native species.

Moderate: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be temporarily outside the natural range of variability. Population numbers, genetic variability, and other demographic factors for species might change, but would be expected

to rebound to pre-impact numbers and to remain stable and viable over time. Frequent responses to disturbance by some individuals could be expected. Sufficient habitat would remain functional to maintain viability of native species.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability for extended periods of time or permanently. Population numbers, genetic variability, and other demographic factors for species might be substantially changed. Frequent responses to disturbance by many individuals would be expected. Loss of habitat might affect the viability of at least some native species.

Alternative A (No Action)

Under the no-action alternative, some wildlife management activities are implemented based on outcomes from inventory and monitoring activities, helping to protect current levels of wildlife in the wilderness areas. Baseline vegetation surveys would be conducted under this alternative. The completed surveys would provide useful information on the current distribution and composition of native species communities. The nonnative species inventory would provide information to management on current distribution and composition of nonnative species that can determine management priorities for the protection of native species in order to maintain the natural wilderness character. There are currently no official routes through the wilderness that would otherwise create a human presence in specific areas or along specific routes that wildlife would begin to avoid. Collectively, these actions would have a long-term, negligible, beneficial effect on wildlife and vegetation due to minimal human presence and better protection of native species communities.

Under this alternative, fires within the wilderness area would continue to be suppressed, which adversely affects vegetation and wildlife habitat as suppression does not facilitate native vegetation growth and regeneration. Fire suppression would have a long-term, minor to moderate, adverse impact on wildlife and vegetation due to improved preservation of native species communities.

Under this alternative, visitors would be informed on how to properly use the wilderness areas so as to minimize the amount of trampling and compaction of vegetation. Current wilderness regulations, such as visitor use limits, the number of horses, no open campfires, and camping restrictions, would continue to be in place. Current protocols for emergency response would remain, minimizing impacts on wildlife due to the use of nonmotorized or mechanized means of transport, which could be noisy and disruptive to wildlife and have greater impacts from trampling and removal of vegetation than the use of horses or hiking in. These actions would have negligible to minor, long-term, beneficial impacts on vegetation and wildlife in the wilderness units due to minimizing noise and human disturbances to wildlife, protecting native species communities by reducing the spread of nonnative species, as well as the amount of trampling or removal of vegetation from use.

In alternative A, current park operations would continue. Current park operations offer limited, if any, training, education, or protocols in how to properly conduct operations in wilderness, including boundary fence maintenance, scientific research, and waste management. Without specific protocols, training, and guidance, vegetation is more likely to be removed or trampled, and wildlife habitat may be disturbed. Also, partnership and public outreach efforts about the value of park wilderness areas would continue to be limited, which does not raise awareness of visitors about the importance of protecting vegetation and wildlife. Collectively, these actions would have a negligible to minor, long-term, adverse impact on

vegetation and wildlife due to the potential for trampling and removal of vegetation.

Cumulative Impacts. Potential future potash mining and residential and commercial development may have potential local and regional effects on vegetation and wildlife due to disturbance from human noise and presence, and the removal of vegetation and subsequent wildlife habitat. Impacts of these actions, combined with impacts of the no-action alternative, would result in long-term, minor, adverse cumulative effects on vegetation and wildlife. The no-action alternative's contribution to this cumulative effect would be slight.

Conclusion. The no-action alternative would result in long-term, minor to moderate, adverse impacts as well as long-term, negligible to minor, beneficial impacts on vegetation and wildlife in wilderness areas. When combined with other past and foreseeable actions, this alternative would have long-term, minor to moderate, adverse and long-term, negligible to minor, beneficial cumulative effects. This alternative's contribution to these effects would be slight.

Alternative B (NPS Preferred Alternative)

Under this alternative, more data would be collected to facilitate appropriate and timely wildlife management protocols, especially if the outcomes are applied to climate change studies. The implementation of a proactive monitoring framework would track conditions of vegetation, wildlife, and habitat and if standards are exceeded, specific management strategies would be implemented to protect wilderness qualities for wildlife. The new, formalized access points could have beneficial impacts on wildlife and vegetation by promoting access to the wilderness units through only these points, thus concentrating impacts such as vegetation trampling or removal, and disturbance to wildlife from human noise and presence in local, formalized, and previously disturbed areas. The implementation of training, education, or protocols in how to properly conduct operations in wilderness, including boundary fence maintenance, scientific research, and waste management, would help protect natural resources due to park staff knowledge of use of nonmotorized or mechanized transport and tools, avoiding sensitive resources (such as biological soil crusts), and keeping noise to a minimum. The boundary fence would be maintained in a manner that would ensure appropriate wildlife migration (antelope). Lastly, the current protocols for emergency response would remain, minimizing impacts on wildlife due to the use of nonmotorized or mechanized means of transport, which could be noisy and disruptive to wildlife and have greater impacts of trampling and removal of vegetation than the use of horses or hiking in. Collectively, these actions would result in a long-term, negligible to minor, beneficial impact due to decreasing the amount of vegetation trampling or removal and disturbance to wildlife from human noise and presence.

Under alternative B, identification of native species distribution and composition and nonnative species management, the development of a vegetation management plan, and working with neighboring property owners to manage invasive plants would provide greater protection and management of native species, than alternative A. Visitors would be better informed through the use of outreach and communication measures than under alternative A, on how to properly use wilderness areas and minimize adverse impacts on vegetation and wildlife. Increased partnerships and public outreach efforts about the value of park wilderness areas may help facilitate protection of vegetation and wildlife. Collectively, these actions would have a minor to moderate, long-term, beneficial impact on vegetation and wildlife due to better protection of native species habitat and communities.

This alternative would include the completion of a fire management plan. Fire management decisions would include minimum

requirements for the wilderness areas, thus providing better resource management and protection. This alternative would have a minor, long-term, beneficial impact on wilderness area vegetation and wildlife due to better preservation of native vegetation and wildlife communities.

Under this alternative, the development of the new formalized access points and trail through the backcountry could have negligible to minor, short-term, adverse, and localized impacts on wildlife during construction due to noise, dust, and an increased human presence; and would have negligible to minor, long-term, adverse, and localized impacts on vegetation during construction due to trampling and removal of slow-growing desert vegetation and the introduction of nonnative species. This alternative provides an additional zone for dispersed backcountry camping in an area that has not been open to overnight use previously, which could disturb wildlife due to increased noise and human presence and impact vegetation through trampling and removal.

Cumulative Impacts. Potential future potash mining and residential and commercial development may have local and potentially regional effects on vegetation and wildlife due to disturbance from human noise and presence, and the removal of vegetation and wildlife habitat. Impacts of the above actions, combined with the impacts of alternative B, would result in long-term, minor, adverse cumulative effects on vegetation and wildlife. The contribution of alternative B to this cumulative effect would be slight.

Conclusion. The action alternative would result in long- and short-term, negligible to minor, adverse impacts and long-term, minor to moderate, beneficial impacts on vegetation and wildlife in the wilderness units. When combined with other past and foreseeable actions, alternative B would have long- and short-term, negligible to minor, adverse and long-term, minor to moderate, beneficial cumulative effects. This alternative's contribution to these effects would be slight.

IMPACTS ON CULTURAL RESOURCES

INTRODUCTION

In this Wilderness Stewardship Plan, impacts to cultural resources are described in terms of type, context, duration, and intensity, which is consistent with CEQ regulations that implement the National Environmental Policy Act. Impact intensity thresholds have been provided to characterize the adverse and beneficial impacts of actions on archeological resources and ethnographic resources.

Duration

Short-term: Impacts occur during project implementation.

Long-term: Impacts occur after (and extend beyond) project completion.

Context

Localized Impacts: Effects would occur in areas within the boundaries of the wilderness units of Petrified Forest National Park.

Regional or Parkwide Impacts: Effects would occur to other areas outside the wilderness units Petrified Forest National Park or in areas of cultural significance beyond the park boundary.

ARCHEOLOGICAL RESOURCES

Methods and Assumptions for Analyzing Impacts

Impacts on archeological resources also affect the "other features and values" quality of wilderness character. The impacts on archeological resources are described in terms of their potential to diminish or protect the ability of archeological resources to yield information important in Southwest prehistory or history:

Negligible:

Impacts would be at the lowest levels of detection, barely perceptible and measurable.

Minor:

Adverse: Disturbance of a site(s) results in little loss of integrity.
Beneficial: Efforts are undertaken to identify and maintain/preserve a site(s) in situ.

Moderate:

Adverse: Site(s) is disturbed with noticeable loss of integrity, but is not obliterated.
Beneficial: More extensive efforts are undertaken to survey, record, and stabilize a site(s) in situ.

Major:

Adverse: Site(s) is disturbed to the extent that most or all of its informational potential is lost or obliterated.
Beneficial: Substantial measures are undertaken to comprehensively survey, document, and preserve a site in situ by extensive or active intervention.

Alternative A (No Action)

Under alternative A, no major changes to park operations or visitor use activities in wilderness areas are anticipated. In consideration of NPS management policy objectives and requirements to preserve wilderness qualities,

there would be little potential for impacts to archeological resources as a result of development actions. Archeological assessments and investigations would continue to be carried out for particular wilderness areas where ground-disturbing project activities, such as paleontological investigations or habitat restoration, may occur. NPS archeologists would continue to routinely monitor the condition of known sites, and would undertake appropriate protection and stabilization measures as necessary to avoid or reduce adverse site impacts occurring from natural processes of wind and water erosion, visitor use (e.g., erosion inadvertently resulting from hiking or horseback riding), the illegal removal of artifacts, and other factors (e.g., trespass livestock). Any adverse effects would likely be long term or permanent, localized, and of negligible to minor intensity.

NPS archeologists would continue to systematically survey wilderness lands, perhaps prioritizing efforts for the north (Painted Desert) unit because most of that area has not been surveyed and visitors are often directed there for wilderness experiences. Identified sites would be recorded and information entered in the NPS Archeological Site Management Information System. Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing in the National Register of Historic Places. Archeological resource management actions would be carried out in accordance with all pertinent laws and policies including consultation with the Arizona SHPO, associated tribes, and other concerned parties under section 106 of the National Historic Preservation Act. These management actions would further advance the documentation and protection of park archeological resources, resulting in long-term minor to moderate, beneficial impacts.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, archeological resources at Petrified Forest National Park. NPS acquisition of land parcels within the expanded boundary of the park is expected to substantially contribute to the existing inventory of prehistoric and historic archeological resources. Although most of the additional lands have not been fully surveyed for archeological resources and few site evaluations have been completed, it is assumed that professional management of these additional resources, in accordance with NPS policies and guidelines, would enhance long-term site protection and the potential for significant sites to yield information contributing to Southwest prehistory and history. These management measures would have a long-term, minor to moderate, beneficial impact on archeological resources.

In common with archeological resources throughout the park, resources in the additional lands are subject to disturbance by natural erosional processes. Past actions, such as the legal extraction of petrified wood, mining, ranching, and other permitted activities on lands managed by the state and Bureau of Land Management (BLM), have also likely contributed to adverse impacts on archeological sites (NPS 2010). Current exploration for potash deposits on non-NPS lands within the expanded boundary of the park, along with the probability of full-scale mining operations in the foreseeable future, present additional threats to archeological resources that may exist on these lands. These actions would have long-term or permanent, minor to major, adverse impacts on archeological resources, depending on whether sites could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative A would have long-term or permanent, negligible to minor, adverse impacts, and minor to moderate, beneficial impacts on park archeological resources. Other past, present, and reasonably foreseeable actions would result in long-term or permanent, minor to major, adverse impacts, and minor to moderate, beneficial impacts on archeological resources. Consequently, the adverse impacts of the other actions described

above, in combination with the impacts of alternative A, would cumulatively result in long-term or permanent, minor to moderate, adverse impacts on archeological resources. The impacts associated with alternative A would represent a very small component of the adverse cumulative impact.

Conclusion. Long-term or permanent, localized, negligible to minor, adverse impacts on the prehistoric and historic archeological resources of the park in wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from the continued management of archeological resources in accordance with NPS policies and guidelines. Long-term or permanent, minor to moderate, adverse, cumulative impacts on archeological resources would result from implementation of alternative A in conjunction with other past, present, or reasonably foreseeable actions.

Alternative B (NPS Preferred Alternative)

Under alternative B, the park would undertake measures to proactively manage wilderness areas to provide comprehensive protection of wilderness character and resources. Toward this objective, archeological resources would be recognized as "other features and values" contributing to the park's wilderness character. In common with the no-action alternative, there would be little likelihood for development-related impacts to archeological resources in wilderness areas because NPS management policy objectives require protection of the untrammeled and undeveloped qualities of wilderness. However, archeological assessments and investigations would continue to be conducted in wilderness areas proposed for ground-disturbing paleontological investigations, habitat restoration, and other research or resource enhancement activities. Areas outside the wilderness units would similarly be assessed for archeological resources where new ground-disturbing development may occur, such as in the adjoining backcountry zone where formalized visitor access trails are proposed. Identified sites would be avoided to the greatest extent possible. NPS archeologists would continue to routinely monitor the condition of known sites, and would undertake appropriate protection and stabilization measures as necessary to avoid or reduce adverse site impacts occurring from wind and water erosion, visitor use (e.g., erosion and compaction inadvertently resulting from hiking or horseback riding), the illegal removal of artifacts, and other factors (e.g., trespass livestock). These site and ground-disturbing processes and actions can adversely affect the information potential of sites if artifacts are displaced or removed, and the in situ context of archeological data is altered or diminished. Any adverse effects would likely be long term or permanent, localized, and of negligible to minor intensity.

NPS archeologists would continue to systematically survey wilderness lands, prioritizing efforts for the north (Painted Desert) unit because most of that area has not been surveyed and visitors are often directed there for wilderness experience. Identified sites would be recorded and information entered on the NPS Archeological Site Management Information System. Additional testing may be conducted for selected sites to address specific research questions and/or to assist determinations of site eligibility for listing in the National Register of Historic Places. Archeological resource management actions would be carried out in accordance with all pertinent laws and policies, including consultation with the Arizona SHPO, associated tribes, and other concerned parties under section 106 of the National Historic Preservation Act. These management actions would further advance the documentation and protection of the park's archeological resources, resulting in long-term, minor to moderate, beneficial impacts.

Under this alternative, the park would adopt a "minimum requirements decision guide" to assist the management of research activities in

wilderness, particularly the excavation and removal of paleontological specimens, and actions associated with archeological testing and data recovery. The selected decision guide alternative would allow the minimal use of hand-held power tools, and the use of mechanical or remote-sensing devices such as ground-penetrating radar. The selective use of nonmotorized wheeled conveyances would be allowed to assist investigations and the transport of equipment and recovered archeological materials. Although data recovery would continue to rely primarily on controlled manual excavations, adoption of the methods and protocols outlined in the decision guide would facilitate archeological research investigations and lessen the potential for recovered artifacts and materials being damaged during transit by the use of nonmechanized means of transport across rugged desert terrain. Resource management actions permitted under the minimum requirements decision guide would result in long-term, minor to moderate, beneficial impacts on archeological resources.

In addition to the archeological resource management actions discussed above, park staff would enhance their efforts to educate and inform visitors of the importance of protecting and not disturbing archeological resources that they may encounter in wilderness and other areas of the park. Increased emphasis on partnerships and outreach with park stakeholders would also present opportunities to advance archeological protection objectives. The National Park Service could partner with adjoining park neighbors, such as the Navajo Nation, to assist with monitoring site conditions and reporting illegal activities such as site looting or the collection of artifacts. The park could also provide technical assistance to associated tribes and other neighbors as needed with regard to site protection or other archeological management issues. Implementation of these visitor use and partnership measures would have long-term, minor to moderate, beneficial impacts on archeological resources.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, archeological resources at Petrified Forest National Park. NPS acquisition of land parcels within the expanded boundary of the park is expected to substantially contribute to the existing inventory of prehistoric and historic archeological resources. Although most of the additional lands have not been fully surveyed for archeological resources and few site evaluations have been completed, it is assumed that professional management of these additional resources, in accordance with NPS policies and guidelines, would enhance long-term site protection and the potential for significant sites to yield information contributing to Southwest prehistory and history. These management measures would have a long-term, minor to moderate, beneficial impact on archeological resources.

In common with archeological resources throughout the park, resources in the additional lands are subject to disturbance by natural erosional processes. Past actions such as the legal extraction of petrified wood, mining, ranching, and other permitted activities on state- and BLM-managed lands have also likely contributed to adverse impacts on archeological sites (NPS 2010). Current exploration for potash deposits on non-NPS lands within the expanded boundary of the park, along with the probability for full-scale mining operations in the foreseeable future, present additional threats to archeological resources that may exist on these lands. These actions would have long-term or permanent, minor to major, adverse impacts on archeological resources depending on whether sites could be avoided, mitigated through data recovery, or are irretrievably lost.

The impacts associated with implementation of alternative B would have long-term or permanent, negligible to minor, adverse impacts, and minor to moderate, beneficial impacts on park archeological resources. Other past, present, and reasonably foreseeable actions would result in long-term or

permanent, minor to major, adverse impacts, and minor to moderate, beneficial impacts on archeological resources. Consequently, the adverse impacts of the other actions described above, in combination with the impacts of alternative B, would cumulatively result in long-term or permanent, minor to moderate, adverse impacts on archeological resources. The impacts associated with alternative B would represent a very small component of the adverse cumulative impact.

Conclusion. Long-term or permanent, localized, negligible to minor, adverse impacts on the prehistoric and historic archeological resources in park wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from continued management of archeological resources in accordance with NPS policies and guidelines, adoption of MRDG protocols, and enhanced public outreach and partnerships. Long-term or permanent, minor to moderate, adverse, cumulative impacts on archeological resources would result from implementation of alternative B, in conjunction with other past, present, or reasonably foreseeable actions.

ETHNOGRAPHIC RESOURCES

Impacts are described in terms of the potential to diminish or protect the integrity of (and access to) resources and places having particular importance and value to traditionally associated groups:

Negligible:
Impacts would be at the lowest levels of detection, barely perceptible, and measurable.

Minor:
Adverse: Impacts would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and the associated group's body of beliefs and practices.

Beneficial: Impacts would allow access to and would accommodate a group's traditional practices or beliefs.

Moderate:
Adverse: Impacts would be apparent and would alter resource conditions or interfere with traditional access, site preservation, or the relationship between the resource and the associated group's beliefs and practices, even though the group's practices and beliefs would survive.

Beneficial: Impacts would facilitate traditional access to and would accommodate a group's practices or beliefs.

Major:
Adverse: Impacts would alter resource conditions. Proposed actions would block or greatly affect traditional access, site preservation, or the relationship between the resource and the associated group's body of beliefs and practices to the extent that the survival of a group's beliefs or practices would be jeopardized.

Beneficial: Impacts would encourage traditional access and would accommodate a group's practices or beliefs.

Alternative A (No Action)

Many places, landmarks, and archeological sites throughout the park retain ethnographic or cultural importance for the Hopi Tribe, the Pueblo of Zuni, the Navajo Nation, and other traditionally associated tribes. Under alternative A, no major changes to park operations or visitor use activities in wilderness areas are anticipated. In consideration of NPS management policy objectives and requirements to preserve

wilderness qualities, there would be little potential for impacts to ethnographic resources as a result of development actions. As necessary, ethnographic resource assessments would accompany archeological investigations of particular wilderness areas where ground-disturbing project activities, such as paleontological investigations or habitat restoration, may occur. NPS staff would continue to routinely monitor the condition of known ethnographic resources and sites, and would undertake appropriate protection and stabilization measures as necessary to avoid or reduce adverse site impacts possibly occurring from natural processes of wind and water erosion, visitor use (e.g., visitors impinging on traditional use areas and activities; erosion inadvertently resulting from hiking or horseback riding), the illegal removal of artifacts, and other factors (e.g., trespass livestock). The integrity of ethnographic resources could be adversely affected by these ground- and site-disturbing processes and activities. This could occur, for example, if cultural objects and materials are displaced or removed, or the ability of traditionally associated tribes to conduct ceremonies and access culturally important places, landmarks, and other resources is disrupted or diminished. Any adverse effects would likely be long-term or permanent, localized, and of negligible to minor intensity.

NPS staff would continue to consult on a government-to-government basis with the traditionally associated tribes. As feasible and in accordance with NPS policies for the protection of wilderness values, tribal recommendations would be considered and incorporated into wilderness planning and management. The park would continue to carry out ethnographic studies and investigations as necessary to better inform decision making and management of ethnographic resources, and would ensure that access is maintained to places and sites having traditional tribal importance. In the event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered in wilderness or other areas of the park, provisions outlined in the Native American Graves Protection and Repatriation Act would be followed. Implementation of these measures in accordance with pertinent laws and NPS policies would have long-term, minor to moderate, beneficial impacts on ethnographic resources.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, ethnographic resources at Petrified Forest National Park. NPS acquisition of land parcels within the expanded boundary of the park is expected to substantially contribute to the existing inventory of prehistoric and historic archeological resources, and it is likely that many of these resources are also culturally important for associated tribes. Traditional use areas and other places of tribal importance may also exist in the newly acquired lands. Although most of the additional lands have not been surveyed for ethnographic resources, it is assumed that professional management of identified resources in consultation with associated tribes and in accordance with NPS policies and guidelines would enhance long-term resource protection. NPS managers would provide tribal members with appropriate access to traditional use areas and resources. These management measures would have long-term, minor to moderate, beneficial impacts on ethnographic resources.

In common with ethnographic and archeological resources throughout the park, resources in the additional lands are subject to disturbance by natural erosional processes. Past human actions such as the legal extraction of petrified wood, mining, ranching, and other permitted activities on state- and BLM-managed lands have likely contributed to adverse impacts on ethnographic resources as a result of site disturbances. Current exploration for potash deposits on non-NPS lands within the expanded boundary of the park, along with the probability for full-scale mining operations in the foreseeable future, present additional threats to ethnographic resources that may exist on these lands and limit traditional tribal access. These actions would

have long-term or permanent, minor to major, adverse impacts on ethnographic resources, depending on whether sites could be avoided or are irretrievably lost, and whether traditional access for tribal groups is maintained.

The impacts associated with implementation of alternative A would have long-term or permanent, negligible to minor, adverse impacts, and minor to moderate, beneficial impacts on park ethnographic resources. Other past, present, and reasonably foreseeable actions would result in long-term or permanent, minor to major, adverse impacts, and minor to moderate, beneficial impacts on ethnographic resources. Consequently, the adverse impacts of the other actions described above, in combination with the impacts of alternative A, would cumulatively result in long-term or permanent, minor to moderate, adverse impacts on ethnographic resources. The impacts associated with alternative A would represent a very small component of the adverse cumulative impact.

Conclusion. Long-term or permanent, localized, negligible to minor, adverse impacts on park ethnographic resources in wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from management of ethnographic resources in accordance with NPS policies and guidelines. Long-term or permanent, minor to moderate, adverse, cumulative impacts on ethnographic resources would result from implementation of alternative A, in conjunction with other past, present, or reasonably foreseeable actions.

Alternative B (NPS Preferred Alternative)

Under alternative B, the park would undertake measures to proactively manage wilderness areas to provide comprehensive protection of wilderness character and resources. In common with the no-action alternative, there would be little likelihood for development-related impacts to ethnographic resources in wilderness units because of NPS management policy objectives and requirements to protect the untrammeled and undeveloped qualities of wilderness. As necessary, ethnographic resource assessments would accompany archeological investigations of particular wilderness areas where ground-disturbing project activities such as paleontological investigations or habitat restoration may occur. Areas outside wilderness units would similarly be assessed for ethnographic resources where new ground-disturbing development or increased visitation may occur such as in the adjoining backcountry zone where formalized access trails are proposed. Identified sites and resources would be avoided to the greatest extent possible. NPS staff would also continue to routinely monitor the condition of known ethnographic resources, and would undertake appropriate protection and stabilization measures as necessary to avoid or reduce adverse site impacts possibly occurring from natural processes of wind and water erosion, visitor use (e.g., erosion inadvertently resulting from hiking or horseback riding), the illegal removal of artifacts, and other factors (e.g., trespass livestock). The integrity of ethnographic resources could be adversely affected by these ground- and site-disturbing processes and activities. This could occur, for example, if cultural objects and materials are displaced or removed, or the ability of traditionally associated tribes to conduct ceremonies and access culturally important places, landmarks, and other resources is disrupted or diminished. Any adverse effects would likely be long term or permanent, localized, and of negligible to minor intensity.

NPS staff would continue to consult on a government-to-government basis with traditionally associated tribes. As feasible and in accordance with NPS policies for the protection of wilderness values, tribal recommendations would be considered and incorporated into wilderness planning and management. The park would continue to carry out ethnographic studies and

investigation as necessary to better inform decision making and management of ethnographic resources, and would ensure that access to places and sites having traditional tribal importance is maintained. In the event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered in wilderness or other areas of the park, provisions outlined in the Native American Graves Protection and Repatriation Act would be followed. Implementation of these measures in accordance with pertinent laws and NPS policies would have long-term, minor to moderate, beneficial impact on ethnographic resources.

In addition to the ethnographic resource management actions discussed above, the park would enhance its efforts to educate and inform visitors of the importance of protecting and not disturbing ethnographic resources and tribal offerings that may be encountered in wilderness and other areas of the park. Increased emphasis on partnerships and outreach with park stakeholders would present opportunities to advance ethnographic protection objectives. The National Park Service could partner with adjoining park neighbors such as the Navajo Nation to assist with monitoring site conditions and reporting observed illegal activities such as site looting or the collection of artifacts. The park could provide technical assistance to associated tribes and other neighbors, as needed, with regard to site protection or other ethnographic/archeological management issues. Implementation of these visitor use and partnership measures would have long-term, minor to moderate, beneficial impacts on ethnographic resources.

Cumulative Impacts. Other past, present, and reasonably foreseeable actions have affected, or have the potential to affect, ethnographic resources at Petrified Forest National Park. NPS acquisition of land parcels within the expanded boundary of the park is expected to substantially contribute to the existing inventory of prehistoric and historic archeological resources, and it is likely that many of these resources are culturally important for associated tribes. Traditional use areas and other places of tribal importance may exist in the newly acquired lands. Although most of the additional lands have not been surveyed for ethnographic resources, it is assumed that professional management of identified resources in consultation with associated tribes and in accordance with NPS policies and guidelines would enhance long-term resource protection. NPS managers would provide tribal members with appropriate access to traditional use areas and resources. These management measures would have long-term, minor to moderate, beneficial impacts on ethnographic resources.

In common with ethnographic and archeological resources throughout the park, resources in the additional lands are subject to disturbance by natural erosional processes. Past human actions such as the legal extraction of petrified wood, mining, ranching, and other permitted activities on state- and BLM-managed lands have likely contributed to adverse impacts on ethnographic resources as a result of site disturbances. Current exploration for potash deposits on non-NPS lands within the expanded boundary of the park, along with the probability for full-scale mining operations in the foreseeable future present additional threats to ethnographic resources that may exist on these lands and limit traditional tribal access. These actions would have long-term or permanent, minor to major, adverse impacts on ethnographic resources, depending on whether sites could be avoided or are irretrievably lost, and whether traditional access for tribal groups is maintained.

The impacts associated with implementation of alternative B would have long-term or permanent, negligible to minor, adverse impacts, and minor to moderate, beneficial impacts on park ethnographic resources. Other past, present, and reasonably foreseeable actions would result in long-term or permanent, minor to major, adverse impacts, and minor to moderate, beneficial

impacts on ethnographic resources. Consequently, the adverse impacts of the other actions described above, in combination with the impacts of alternative B, would cumulatively result in long-term or permanent, minor to moderate, adverse impacts on ethnographic resources. The impacts associated with alternative B would represent a very small component of the adverse cumulative impact.

Conclusion. Long-term or permanent, localized, negligible to minor, adverse impacts on park ethnographic resources in wilderness areas would occur from erosion, visitor use, and other factors. Long-term, minor to moderate, beneficial impacts would result from management of ethnographic resources in accordance with NPS policies and guidelines, and enhanced public outreach and partnerships. Long-term or permanent, minor to moderate, adverse, cumulative impacts on ethnographic resources would result from implementation of alternative B in conjunction with other past, present, or reasonably foreseeable actions.

IMPACTS ON VISITOR USE AND EXPERIENCE

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

Impacts on visitor use and experience were determined considering the best available information. Information on visitor use and opinions specific to Petrified Forest National Park wilderness units was taken from surveys of visitors conducted by Northern Arizona University School of Forestry in 2001 and 2002. A survey of the U.S. public was also used to inform this analysis. Other information that was considered in the analysis includes annual visitor use levels in the park, including overnight stays, as reported by the NPS Public Use Statistics Office. The NPS Air Resources Division and Natural Sounds and Night Skies Division were also contacted to receive information pertaining to the importance of these resources and associated visitor experience in wilderness. All of this background data was supplemented by information gathered during the planning process for this Wilderness Stewardship Plan, including opinions from park visitors and neighbors, and information from park staff. The definitions used to determine impacts on visitor use and experience are defined as follows:

Duration

Short-term Impacts. Effects that would be temporary, lasting a year or less.
Long-term Impacts. Effects that would last more than one year and could be permanent.

Context

Localized Impacts: Effects would occur in areas within the boundaries of the wilderness units of Petrified Forest National Park.
Regional or Parkwide Impacts: Effects would occur to other areas outside the wilderness units of Petrified Forest National Park or in areas of natural significance beyond the park boundary.

Scale/Intensity Thresholds

The scale or intensity of impacts refers to the change(s) associated with the action alternative when compared to current and future conditions under the no-action alternative. Factors considered in assessing the scale and intensity include the relative magnitude of changes, the likelihood of people being aware of the changes, the ability to measure the effects of the changes, and the number of people or size of the geographic area that would be affected. The scale/intensity thresholds for visitor use and experience are defined as follows:

Negligible: Most visitors would likely be unaware of any effects associated with the implementation of the alternative.

Minor: Changes in visitor opportunities and/or setting conditions would be slight but detectable, would affect few visitors, and would not appreciably limit or enhance wilderness-related visitor experiences.

Moderate: Changes in visitor opportunities and/or setting conditions would be noticeable, would affect many visitors, and would result in some changes to wilderness-related visitor experiences.

Major: Changes in visitor opportunities and/or setting conditions would be highly apparent,

would affect most visitors, and would result in several changes to wilderness-related visitor experiences.

Type/Character

Beneficial. Effects that improve or enhance wilderness-related opportunities and visitor experiences.

Adverse. Effects that reduce the quality of, degrade, or diminish wilderness-related opportunities and visitor experiences.

The impact analysis considers various aspects of visitor use and experience for the wilderness at Petrified Forest National Park, including the following topics.

Visitor Experiences of Viewsheds, Dark Night Skies, Natural Soundscapes

The wilderness areas of the park provide expanded opportunities for visitors to experience the fundamental resources and values of the park. Of those fundamental resources and values, the visitor experience related to viewsheds, dark night skies, and natural soundscapes are discussed in more detail because of the potential impacts from actions adjacent to the park.

Opportunities and Experiences of Solitude or Primitive and Unconfined Recreation in Wilderness

Wilderness areas should provide outstanding opportunities for solitude or primitive and unconfined recreation (Landres et al. 2008). This quality is degraded by settings that reduce these opportunities, such as encounters with other wilderness visitors, signs of modern civilization adjacent to the wilderness that affect these opportunities inside wilderness, facilities provided by the agency or created by users that reduce visitor self-reliance, and management restrictions on visitor behavior. Recreation-focused developments (such as trails, campsites, shelters, or restrooms) can also impact visitors ability to experience solitude or primitive and unconfined recreation.

Opportunities to Understand the Wilderness Concept

Visitors to Petrified Forest National Park wilderness units were uncertain about the location of wilderness boundaries and about the concept of wilderness in general. In a visitor survey conducted by Northern Arizona University, 74% of visitors did not know about the wilderness units in Petrified Forest National Park before they came, but 54% said they learned about the wilderness units during their visit. Additionally, 25% of visitors said they were familiar with the national wilderness preservation system, while 54% said they were not familiar, and 21% were not sure (Lee, Hockenberry, and Delost 2002).

Ability to Access the Wilderness

Currently, the only designated access point into park wilderness is at Kachina Point, near the north wilderness unit. Maintaining this access point, or creating new access routes into wilderness could impact wilderness use and visitor experiences.

Visitor Safety

The health and safety of park visitors, staff, and neighbors are of great importance to the National Park Service. However, visitors take inherent risks when they enter the wilderness areas. During the summer season, the lack of shade and extreme temperatures can pose risks to hikers if they do not come prepared for this environment. Because there are no signs, no trails, no permanent water sources, and no facilities; visitors must come prepared to be entirely self-reliant.

ALTERNATIVE A (NO ACTION)

Visitor Experiences of Viewsheds, Dark Night Skies, Natural Soundscapes

Under alternative A, wilderness visitors would continue to have opportunities for exploration in a vast and open landscape of magnificent viewsheds, dark night skies, and natural soundscapes. There would be few management actions that would impact visitor experience of these resources, and most threats would be due to possible developments that would occur outside of wilderness and park boundaries. However, there would be long-term, negligible to minor, beneficial impacts to the visitor experience of viewsheds due to the continued policy of no developments and dispersed camping in wilderness, therefore keeping visibility of developments and people to a minimum. Additionally, there would be long-term, negligible, beneficial impacts to visitor experience of viewsheds and dark night skies due to a continued policy banning open campfires, therefore eliminating visual intrusions from campfires. Because air quality data is collected outside the wilderness areas, there would be no impacts to visitor experience of viewsheds due to monitoring equipment. However, there would be short-term, negligible, adverse, localized impacts to visitor experience of soundscapes due to the presence of personnel and equipment used for research and removal of paleontological objects, for general scientific research, for archeological and historical surveys, and for monitoring ethnographic resources. There would be long-term, negligible, beneficial impacts to visitor experience of soundscapes due to continued wilderness regulations for group size, number of overnight campers, and leashed pets. These regulations would minimize the opportunities for soundscape intrusions. There would be long-term, minor, adverse impacts to visitor experience of soundscapes due to presence of park staff for maintenance of the boundary fence and associated access roads on an as needed basis. Because management actions impacting visitor experience of viewsheds, dark night skies, and natural soundscapes would be minimal under alternative A; overall there would be long-term, negligible, beneficial impacts to viewsheds and dark night skies and short-term, intermittent, negligible, adverse impacts to visitor experience of soundscapes.

Opportunities and Experiences of Solitude or Primitive and Unconfined Recreation in Wilderness

Under alternative A, visitors would continue to have a multitude of opportunities for solitude and primitive and unconfined types of recreation in wilderness. However, park management actions would affect these opportunities and experiences. For example, there would be continued short-term, negligible, adverse, localized impacts to visitor opportunities for solitude and primitive and unconfined types of recreation due to the presence of personnel and equipment used for removal of paleontological objects, for archeological and historical surveys, monitoring ethnographic resources, or used for other research activities including night sky and soundscape monitoring in wilderness. There would be long-term, negligible, beneficial, impacts to opportunities for solitude and primitive recreation due to the continued policy of no development, dispersed camping, cross-country travel across the backcountry for accessing the wilderness, and continued wilderness regulations for group size and number of overnight campers, leashed pets, and restrictions on open campfires.

Opportunities to Understand the Wilderness Concept

Under alternative A, opportunities for visitors to learn about wilderness would remain the same. Interpretation and educational messages about wilderness would continue to be available through rangers, the park website and newspaper, and wilderness-specific

information would be provided to visitors requesting overnight permits. Additionally, the existing trailhead wayside provided at Kachina Point would continue to inform visitors about the north wilderness unit. However, it is likely that some visitors would continue to be uncertain about the location of wilderness boundaries and about the concept of wilderness in general. In a visitor survey conducted by Northern Arizona University, 74% of visitors did not know about the wilderness units in Petrified Forest National Park before they came, but 54% said they learned about the wilderness units during their visit. Additionally, 25% of visitors said that they were familiar with the national wilderness preservation system, while 54% said they were not familiar, and 21% were not sure (Lee, Hockenberry, and Delost 2002). These findings demonstrate that many visitors did not know about wilderness as a concept, and some visitors were confused about the location of wilderness boundaries in Petrified Forest National Park. Therefore, this alternative would have long-term, moderate, adverse impacts to visitor experience due to limited opportunities to learn about and gain an understanding of wilderness concepts.

Ability to Access the Wilderness

Alternative A would continue to allow undesignated cross-country travel across the backcountry for access to the wilderness units. Located in the north wilderness unit, the existing trailhead wayside provided at Kachina Point would continue to inform visitors of access into the north wilderness unit. Because no trails, maps, or signs exist to indicate access into other areas of the north wilderness unit or into the south wilderness unit, visitors would likely continue to be confused about wilderness boundaries and access points. The lack of information about how to access the wilderness units and related confusion among visitors would result in long-term, moderate, adverse impacts to visitor ability to access the wilderness areas.

Visitor Safety

Under alternative A, the health and safety of park visitors, staff, and neighbors would continue to be of great importance to the National Park Service. However, visitors would take inherent risks when they enter the wilderness areas. During the summer season, the lack of shade and extreme temperatures can pose risks to hikers if they do not come prepared for this environment. Because there are no signs, no trails, no permanent water sources, and no facilities; visitors must come prepared to be entirely self-reliant. Under alternative A, the park would continue using the emergency response plan and would travel on horseback or by foot to carry injured or sick visitors out of the wilderness. Under this alternative, there would be long-term, negligible, beneficial impacts to visitor safety due to the use of current procedures for the emergency response plan. There would also be long-term, negligible, beneficial impacts to visitor safety due to the continued requirement to exit the wilderness during daylight hours, reducing the chance of visitors becoming disoriented or injured during nighttime hours. However, alternative A does not provide policy or education for sanitation or waste management in backcountry or wilderness. This would result in long-term, minor to moderate, adverse impacts to visitor experience and safety as related to waste management.

Alternative A would result in long-term, negligible, beneficial impacts to visitor experience of viewsheds, dark night skies, solitude and primitive and unconfined types of recreation, and to visitor safety. Alternative A would result in short-term, negligible, adverse impacts to visitor experience of soundscapes and opportunities for solitude and primitive and unconfined types of recreation. There would be long-term, moderate, adverse impacts to opportunities to learn about the wilderness concept, visitor ability to access the wilderness, and to visitor safety.

Cumulative Impacts. Several past, present, or reasonably foreseeable actions may affect the quality of wilderness experience for visitors. These actions are directly related to visitor experience of viewsheds, dark night skies, soundscapes, and opportunities and experiences of solitude and primitive and unconfined types of recreation in wilderness. Past and present impacts adversely affecting visitor experience include the visibility of communication towers along Interstate 40, noise from vehicles on the interstate and trains on the Burlington Northern Santa Fe Railway, noise and visibility of overflights and air tours, light emitted from the algae bioscience production facility west of the park, visibility of scattered residential and commercial developments near the park, visibility of wind and solar developments, and visibility and noise related to potash mines. Possible future impacts to visitor experience include increases in the aforementioned developments and activities, and the new development of a casino, hotel, campground, and truck stop at the Pinta exit south of Interstate 40 on an escarpment overlooking the north wilderness area of the park. This new development would have adverse impacts on viewsheds, dark night skies, soundscapes, and opportunities and experiences of solitude and primitive and unconfined types of recreation. In contrast, the past, present, and future NPS acquisition of properties within the park's expanded boundary would create a buffer for certain sections of the wilderness boundary, therefore beneficially impacting visitor experience by protecting viewsheds, dark night skies, soundscapes, and opportunities and experiences of solitude and primitive and unconfined types of recreation.

There would be adverse impacts to visitor experience due to development and activities occurring outside the park boundary, and beneficial impacts to visitor experience from past, present, and future NPS acquisition of properties within the expanded boundary of the park. Overall, there would be long-term, minor to moderate, beneficial impacts to visitor experience when the effects of alternative A are added to the effects of NPS property acquisitions. However, there would be short-term to long-term, minor to moderate, adverse impacts to visitor experience when the impacts of alternative A are added to the effects of external developments and activities occurring outside wilderness areas and park boundaries. The impacts associated with NPS action would represent a very small or nonexistent component of the adverse cumulative impact.

Conclusion. Alternative A would result in long-term, negligible, beneficial impacts to visitor experience of viewsheds, dark night skies, solitude and primitive and unconfined types of recreation, and to visitor safety. Alternative A would result in short-term, negligible, adverse impacts to visitor experience of soundscapes and opportunities for solitude and primitive and unconfined types of recreation. There would be long-term, moderate, adverse impacts to opportunities to learn about the wilderness concept, visitor ability to access wilderness areas, and to visitor safety.

Overall, there would be long-term, minor to moderate, beneficial impacts to visitor experience when the effects of alternative A are added to the effects of NPS property acquisition. However, there would be short-term to long-term, moderate, adverse impacts to visitor experience when the impacts of alternative A are added to the effects of external developments and activities occurring outside wilderness areas and park boundaries.

ALTERNATIVE B (NPS PREFERRED ALTERNATIVE)

Experiences of Viewsheds, Dark Night Skies, Natural Soundscapes

Under alternative B, visitors to wilderness areas would continue to have opportunities for exploration in a vast and open landscape of magnificent viewsheds, dark night skies, and natural soundscapes. There would be few

management actions that would impact visitor ability to experience these resources, and most threats would be due to possible development that would occur outside wilderness and park boundaries. However, under alternative B, a fire management plan would be completed for the park, including wilderness areas. Fire management activities may cause short-term, moderate, adverse, localized impacts to the visitor experience of viewsheds during prescribed burns. There would be long-term, negligible to minor, beneficial impacts to the visitor experience of viewsheds due to the continued policy of no development in wilderness areas and the use of dispersed camping, therefore keeping visibility of developments and people to a minimum. There would also be long-term, negligible, beneficial impacts to visitor experience of viewsheds and dark night skies due to a continued policy banning open campfires, therefore eliminating visual intrusions from campfires. Under this alternative, managers would educate park staff and visitors about park air quality and trends and class I air quality requirements resulting in long-term, minor, beneficial impacts to visitor experience due to increased awareness of air quality. Under alternative B, managers would showcase dark night skies and educate partners about the beneficial effects of reducing light pollution, and would educate park staff and visitors about traveling quietly and minimizing the use of artificial portable lighting in wilderness. Because of these actions, there would be long-term, minor, beneficial impacts to visitors appreciating dark night skies and soundscapes in wilderness. However, there would be short-term, negligible, adverse, localized impacts to visitor experience of soundscapes due to the presence of personnel and equipment used for research and removal of paleontological objects, for general scientific research, for archeological and historical surveys, and for monitoring ethnographic resources. In contrast to alternative A, alternative B would have short-term, minor, beneficial, localized impacts to visitor experience of soundscapes due to thoughtful utilization of minimum requirements to reduce the number of trips to the field for the aforementioned activities, and for maintenance of the boundary fence and associated access roads, therefore minimizing the associated effects of noise. There would be long-term, negligible, beneficial impacts to visitor experience of soundscapes due to continued wilderness regulations for group size, number of overnight campers, and leashed pet rules. These regulations would minimize the opportunities for soundscape intrusions. Because management actions impacting visitor experience of viewsheds, dark night skies, and natural soundscapes would be minimal and thoughtful utilization of minimum requirements would be applied; alternative B would result in both short-term, moderate, adverse impacts and long-term, negligible to minor, beneficial impacts to visitor experience of viewsheds, and would result in long-term, minor, beneficial impacts to visitor experience of dark night skies, and short-term, negligible, adverse impacts and long-term, negligible, beneficial, impacts to visitor experience of soundscapes.

Opportunities and Experiences of Solitude or Primitive and Unconfined Recreation in Wilderness

Alternative B is similar to alternative A because visitors would continue to have a multitude of opportunities for solitude and primitive and unconfined types of recreation in wilderness, and park management actions would affect these opportunities and experiences. For example, there would be continued short-term, negligible, adverse, localized impacts to visitor opportunities for solitude and primitive and unconfined types of recreation due to the presence of personnel and equipment used for removal of paleontological objects, for archeological and historical surveys or stabilization efforts, monitoring of ethnographic resources, or used for other research activities including night sky and soundscape monitoring in wilderness. There would also be long-term, negligible, beneficial, impacts due to continued policy of no developments, dispersed camping, cross-country travel

across the backcountry for accessing wilderness areas, and continued wilderness regulations for group size and number of overnight campers, leashed pets, and restrictions on open campfires. These regulations would provide opportunities to experience solitude. In contrast to alternative A, alternative B would consider volunteers and education groups to assist in the inventory, monitoring, and documentation of paleontological sites in wilderness. Actions under alternative B would adhere to a new programmatic MRDG for conducting research within wilderness. Therefore, there would be short-term, negligible, beneficial impacts to wilderness volunteers and educational groups that assist with paleontological research due to new opportunities to learn about wilderness character. There would also be short-term, minor, beneficial, localized impacts to visitor opportunities for solitude and primitive and unconfined types of recreation due to thoughtful utilization of minimum requirements to reduce the number of trips into the field for all research efforts and for maintenance of the boundary fence and associated access roads. Under alternative B, optional administrative access points into the wilderness units would be considered for research and monitoring to prevent establishment of well-defined administrative trails in the wilderness (i.e., ease of access, efficiency in work, minimize impacts on wilderness qualities such as solitude, trammeling, etc.). This would result in long-term, minor, beneficial impacts to visitor opportunities for solitude and primitive and unconfined types of recreation due to the creation of optional administrative access points into wilderness areas. Minimizing access points would help ensure visitor opportunities for solitude and could prevent trammeling from trails. Overall, alternative B would result in short- and long-term, negligible to minor, beneficial impacts to opportunities for solitude and primitive and unconfined types of recreation. There would also be short-term, negligible, adverse, localized impacts to opportunities for solitude and primitive and unconfined types of recreation.

Opportunities to Understand the Wilderness Concept

Under alternative B, opportunities for visitors to learn about the wilderness concept would be improved through increased educational and interpretive efforts. Interpretation and educational messages about wilderness would continue to be available through rangers, the park website and newspaper, and wilderness-specific information would be provided to visitors requesting overnight permits. Additionally, the existing trailhead wayside provided at Kachina Point would continue to inform visitors about the north wilderness unit. New media for communicating wilderness values, safety, and appropriate uses would also be developed to better inform the public about wilderness. Media could include displays, waysides, books, brochures, videos, and webpages. Students would be offered additional education about wilderness etiquette and how to conduct research and studies in wilderness, and interpretive programs would be enhanced to provide visitors with additional opportunities to learn about and experience the wilderness (e.g., ranger walks). Volunteers, partners, neighbors, and education groups would have new opportunities to learn about wilderness or to assist in wilderness inventory, monitoring, and documentation. There would be improved training for park staff, especially front-line staff, regarding park wilderness areas, regulations, resources, and opportunities for visitors in the wilderness, resulting in improved visitor education. Through these efforts, it is likely that park visitors would be aware of the location of wilderness boundaries and would gain clarity about the concept of wilderness in general. In a visitor survey conducted by Northern Arizona University, 74% of visitors did not know about the wilderness units in Petrified Forest National Park before they came, but 54% said they learned about the wilderness units during their visit. Additionally, 25% of visitors said that they were familiar with the national wilderness preservation system, while 54% said they were not familiar, and 21% were not sure (Lee, Hockenberry, and Delost 2002). Research

findings demonstrated that many visitors did not know about wilderness as a concept, and some visitors were confused about the location of wilderness boundaries in Petrified Forest National Park. Therefore, improvements made under alternative B would result in long-term, moderate, beneficial impacts to visitor experience due to increased opportunities to learn about wilderness concepts.

Ability to Access the Wilderness

Unlike alternative A, alternative B would provide new opportunities for visitors to access the wilderness and new places for visitors to camp in the backcountry zone. Located in the north wilderness unit, the existing trailhead wayside provided at Kachina Point would continue to inform visitors of access into the north wilderness unit. However, the trail leading from this wayside would be formalized under alternative B, and public access points into the north wilderness unit from Tiponi Point and Devil's Playground may also be established for future use. A new backcountry camping area (zone 5) would be established under alternative B, along with wilderness maps delineating camping zones. These actions would lead to long-term, moderate, beneficial impacts to visitor awareness of wilderness boundaries and the ability to access wilderness areas. Under alternative B, the new access points would be standardized and park staff would be educated about how to inform visitors of access to the south wilderness unit. This would result in long-term, minor, beneficial impacts to visitor experience and ability to access the wilderness due to increased education of park staff, and resulting shared knowledge pertaining to south wilderness unit access points. Monitoring would be conducted to assess the effect of additional formal access points on select wilderness values, and a trail register would be built to capture how and when visitors are accessing the north wilderness unit. Because a fire management plan would be completed for the park, including the wilderness area, there would be short-term, moderate, adverse, localized impacts to visitor access due to fire management activities. However, the impacts from fire management, if needed, would only contribute a small increment of adverse impacts to visitor access when compared to the multitude of beneficial impacts to visitor access under alternative B. Therefore, alternative B would generally result in long-term, minor to moderate, beneficial impacts on visitor access to wilderness areas.

Visitor Safety

Similar to alternative A, the health and safety of park visitors, staff, and neighbors would continue to be of great importance to the National Park Service under alternative B. Visitors would take inherent risks when they enter the wilderness areas, especially during the summer season when the lack of shade and extreme temperatures can pose risks to hikers if they do not come prepared for this environment. Because there are no signs, no trails, no permanent water sources, and no facilities; visitor must come prepared to be entirely self-reliant. Similar to alternative A, the park would continue emergency response on horseback or by foot to carry out injured or sick visitors from the wilderness areas. Under this alternative, there would be long-term, negligible, beneficial impacts to visitor safety due to the use of current procedures for the emergency response plan. There would also be long-term, negligible, beneficial impacts to visitor safety due to the continued requirement to exit the wilderness during daylight hours. However, in contrast to alternative A, alternative B would provide policy and education for sanitation and waste management in backcountry or wilderness. This would result in long-term, minor to moderate, beneficial impacts to the visitor experience and safety as related to waste management. A trail register would be built under alternative B, allowing the emergency response team access to information and whereabouts of day use visitors. This awareness would result in long-term, minor, beneficial impacts to visitor safety. Alternative

B would also allow for dispersed camping in the backcountry during times when Lithodendron Wash is impassible, during inclement weather, or other circumstances deemed necessary by park management, and new zone (zone 5) would be designated for backcountry camping. This action would lead to long-term, minor, beneficial, localized impacts to visitor safety. Finally, alternative B would provide improved media for communicating wilderness values, safety, and appropriate uses to the public, resulting in long-term, moderate, beneficial impacts to visitor safety. Therefore, alternative B would result in long-term, negligible to moderate, beneficial impacts to visitor safety overall.

Compared to alternative A, alternative B provides for a variety of improvements, resulting in mostly beneficial impacts to the visitor experience. There would be long-term, negligible to moderate, beneficial impacts to the visitor experience of viewsheds, dark night skies, soundscapes, opportunities for primitive and unconfined types of recreation, opportunities to learn about the wilderness concept, ability to access the wilderness, and to visitor safety. There would be a small contribution of adverse impacts to visitor experience including short-term, negligible, adverse impacts to the visitor experience of soundscapes and opportunities for solitude and primitive and unconfined types of recreation, and possible short-term, moderate, localized, adverse impacts to viewsheds.

Cumulative Impacts. Several past, present, or reasonably foreseeable actions may affect the quality of wilderness experiences for visitors. These actions are directly related to the visitor experience of viewsheds, dark night skies, soundscapes, and opportunities and experiences of solitude and primitive and unconfined types of recreation in wilderness. Past and present impacts adversely affecting visitor experience include the visibility of communication towers along Interstate 40, noise from vehicles on the interstate and trains on the Burlington Northern Santa Fe Railway, noise and visibility of overflights and air tours, light emitted from the algae bioscience production facility west of the park, visibility of scattered residential and commercial developments near the park, visibility of wind and solar developments, and visibility and noise related to potash mines. Possible future impacts to visitor experience include increases in the aforementioned developments and activities, and the new development of a casino, hotel, campground, and truck stop at the Pinta exit south of Interstate 40 on an escarpment overlooking the north wilderness area of the park. This new development would have adverse impacts on viewsheds, dark night skies, soundscapes, and opportunities and experiences of solitude and primitive and unconfined types of recreation. In contrast, the past, present, and future NPS acquisition of properties within the expanded park boundary would create a buffer for certain sections of the wilderness boundary, therefore, beneficially impacting visitor experience by protecting viewsheds, dark night skies, soundscapes, and opportunities and experiences of solitude and primitive and unconfined types of recreation. There would be adverse impacts to visitor experience due to development and activities occurring outside the park boundary, and beneficial impacts to visitor experience from past, present, and future NPS acquisition of properties within the expanded park boundary. Overall, there would be long-term, moderate, beneficial impacts to visitor experience when the effects of alternative B are added to the effects of NPS property acquisition. However, there would also be short-term to long-term, negligible to moderate, adverse impacts to visitor experience when the impacts of alternative B are added to the effects of external development and activities occurring outside wilderness areas and park boundaries. The impacts associated with NPS action would represent a very small or nonexistent component of the adverse impact.

Conclusion. Compared to alternative A, alternative B provides a variety of improvements, resulting in mostly beneficial impacts to visitor experience. There would be long-

term, negligible to moderate, beneficial impacts to the visitor experience of viewsheds, dark night skies, soundscapes, opportunities for primitive and unconfined types of recreation, opportunities to learn about the wilderness concept, the ability to access wilderness areas, and to visitor safety. There would be a small contribution of adverse impacts to the visitor experience including short-term, negligible, adverse impacts to the visitor experience of soundscapes and opportunities for solitude and primitive and unconfined types of recreation, and possible short-term, moderate, localized adverse impacts to viewsheds.

Overall, there would be long-term, moderate, beneficial impacts to visitor experience when the effects of alternative B are added to the effects of NPS property acquisition. However, there would be short-term to long-term, negligible to moderate, adverse impacts to visitor experience when the impacts of alternative B are added to the effects of external developments and activities occurring outside wilderness areas and park boundaries.

IMPACTS ON PARK OPERATIONS

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

Implementation of a project or management plan can affect park operations, such as the number of employees needed, the type of duties that need to be conducted, how activities should be conducted, and administrative procedures. The methods for assessing impacts on park operations are based on how each alternative would affect such aspects of park operations, in the professional opinion of park staff, other NPS specialists, and the public. The definitions used to determine impacts are described as follows:

Duration

Short-term: Impacts are temporary (would last for less than one year) and are typically transitional impacts associated with implementing an action.

Long-term: Impacts may extend beyond one year and could be permanent.

Scale/Intensity Threshold

The thresholds used to assess potential changes in park operations are described as follows:

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 mitigation were needed to offset adverse effects, it would be relatively simple and successful.

Moderate. The effects would be readily apparent and would result in a substantial change in park operations that is noticeable to park staff and the public. Mitigation measures 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 substantial change in park operations that is noticeable to staff and the public, and would be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, could be expensive, and success could not be guaranteed.

ALTERNATIVE A (NO ACTION)

Under the no-action alternative, NPS operational activities would remain focused on baseline resource surveys, condition assessments, resource protection, and on resource inventorying and monitoring. There would also be continued operational investment devoted to managing visitor use and experience, including permitting and managing applicable regulations, in the wilderness area. NPS administrative access to the wilderness area would continue to remain challenging because of the lack of access points. Emergency response and search and rescue activities would continue to include infrequent transport of injured or sick people out of the wilderness, and other necessary emergency operations. Other operations within the wilderness boundary would include the continuation of the repair and construction of the boundary fence and

scientific activities. Under the no-action alternative, the park staff would manage the wilderness area operational load with current staffing levels, if possible. Considering all of the above, the no-action alternative's effect on park operations would continue to be long term, minor, and adverse.

Cumulative Impacts. Potential future potash mining and residential and commercial development would require park staff to work cooperatively with neighbors and other entities to minimize potential effects on park resources and values, resulting in increased staff time. Impacts of the above actions, combined with the impacts of the no-action alternative, would result in long-term, minor, adverse cumulative effects on park operations. The no-action alternative's contribution to this cumulative effect would be slight.

Conclusion. The no-action alternative's effect on park operations would continue to be minor and adverse. The cumulative effect on park operations would be long-term, minor, and adverse. The no-action alternative's contribution to this effect would be slight.

ALTERNATIVE B (NPS PREFERRED ALTERNATIVE)

Under alternative B, NPS operational activities would remain focused on baseline resource surveys, condition assessments, resource protection, and on resource inventorying and monitoring. There would also be continued and new operational investment devoted to managing visitor use and experience, including permitting and managing applicable regulations and monitoring and managing additional components of visitor use (such as a newly designated backcountry camping zone and additional access points, providing new and enhanced interpretation and educational opportunities, increasing understanding and awareness through partnership development and public outreach, and human waste management) in the wilderness areas. NPS administrative access to the wilderness areas would be easier due to the formalization of additional access points. Emergency response and search and rescue activities would continue to include infrequent transport of injured or sick people out of the wilderness areas, and other necessary emergency operations. Other operations within the wilderness boundary would include increased horse and foot patrols, and the continuation of the repair and construction of the boundary fence and scientific activities. Under alternative B, park staff would manage the wilderness areas operational load with current staffing levels. Considering all of the above, the effect of alternative B on park operations would be long term, moderate, and beneficial and adverse.

Cumulative Impacts. Potential future potash mining and residential and commercial development would require that park staff work cooperatively with neighbors and other entities to minimize potential effects on park resources and values, resulting in increased staff time. Impacts of the action alternative, combined with the impacts of other actions, would result in long-term, moderate, and adverse cumulative impacts; the action alternative's contribution to this cumulative effect would be substantial.

Conclusion. The action alternative's effect on park operations would be long term, moderate, and beneficial and adverse. The cumulative effect on park operations would be long term, moderate, and adverse; the action alternative's contribution to this effect would be substantial.

IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

The National Park Service applied logic, experience, professional expertise, and professional judgment in analyzing the effects on the socioeconomic conditions resulting from the no-action and NPS action alternatives. Available economic data, visitor use data, and park data were used to identify and evaluate likely effects. The regional economy for this impact topic is Apache and Navajo counties.

The two main factors considered in this analysis were

- changes in staffing and federal spending
- changes in visitor use levels and corresponding changes in consumer spending

Duration

Short-term: Impacts are temporary (would last for less than one year) and are typically transitional impacts associated with implementing an action.

Long-term: Impacts may extend beyond one year and could be permanent.

Scale/Intensity

The scale or intensity of impacts refers to the change(s) associated with the action alternative when compared to current and future conditions under the no-action alternative. Factors considered in assessing the scale and intensity include the relative magnitude of changes, the likelihood of people being aware of the changes, the ability to measure the effects of the changes, and the number of people or size of the geographic area that would be affected. The scale/intensity thresholds for economic and social conditions are described as follows:

Negligible. Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be barely detectable or detectable only through indirect means, and with no discernible impact on local social or economic conditions over the long term.

Minor. Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be small but detectible, geographically localized, and affect few people, and effects would not be expected to substantively alter established social or economic structures over the long term.

Moderate. Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be readily apparent or observable across a wider geographic area, would affect many people, and could have noticeable effects on the established economic or social structure and conditions over the long term.

Major. Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be readily detectable or observable, extend across much of the community or region, affect a large segment of the population, and have a substantial influence on the established social or economic conditions over the long term.

Type/Character

Beneficial. Effects that many individuals or groups would accept or recognize as improving economic or social conditions, either in general or for a specific group of people, businesses, organizations, or institutions. Examples of beneficial effects include higher real personal income, lower unemployment, and increased social diversity and economic sustainability.

Adverse. Effects that many individuals or groups would accept or recognize as diminishing economic or social conditions, either in general or for a specific group of people, businesses, organizations, or institutions. Examples of adverse effects include reduced real personal income, higher unemployment, and an increase in the cost of living.

ALTERNATIVE A (NO ACTION)

Under the no-action alternative, there would continue to be a lack of public access and opportunities for park visitors in the wilderness units. Education and interpretation information would continue to be provided as it is currently, with no additional waysides, brochures, or other interpretive media. The no-action alternative does not contain any provisions that would stimulate a change in visitation. Therefore, the local and regional economy would not benefit from increased visitor spending in the area. In addition, the National Park Service would not be expected to increase its annual operating costs or staffing from current levels over the long term. The only increase in spending would be from any resource inventories that might occur.

Although the no-action alternative is not expected to create local jobs or increase long-term NPS federal spending, any spending relative to continued resource inventories would have a negligible, long-term, beneficial effect on the socioeconomic environment from spending on overnight accommodations and in restaurants and associated tax revenues.

Cumulative Impacts. The area considered for evaluating cumulative impacts on the socioeconomic environment are Holbrook (the local economy) and Apache and Navajo counties (the regional economy). Reasonably foreseeable future actions in or adjacent to the wilderness areas include potash mining, residential and commercial development, and other new projects in the region such as wind and solar energy development and the potential Navajo Nation casino project. Development projects would be expected to create temporary construction and engineering jobs, with permanent operations and maintenance staff remaining after construction.

The economic viability of mining potash deposits and the possible construction of the casino would depend on future market conditions, including commodity prices and the overall health of the economy. If market conditions are favorable and profit margins outweigh potential risks, then potash mining and construction and operation of the casino would provide new jobs, consumer spending (including multiplier effects) in the area, and sales tax revenue that would beneficially impact the local and regional economy.

Residential and commercial growth and development is expected to gradually increase within both Navajo and Apache counties according to population projections. Given the rural nature of the lands surrounding the park, much of the population increase is likely to be absorbed by existing communities/employment centers with established infrastructure. The rate of growth is expected to be slow, but could result in new construction and real estate related jobs and new property tax revenue. This growth might be mitigated in the short term by the economic recession that began in 2007. If population growth does occur, the addition of taxable property and consumer spending would likely have a

beneficial impact on the socioeconomic environment over the long term.

The addition of jobs, direct and indirect consumer spending, and tax revenue would benefit the local and regional economy.

Overall, the effects on the socioeconomic environment of the two counties from implementing the no-action alternative would be long term, minor to moderate, and beneficial.

Combining the likely effects of implementing the no-action alternative with the effects of other reasonably foreseeable future actions, there would be a long-term, minor to moderate, and beneficial cumulative impact on the socioeconomic environment. The no-action alternative would contribute a very small increment to this cumulative impact.

Conclusion. The no-action alternative would have negligible, long-term, beneficial effects on the socioeconomic environment as a result of modest one-time federal spending. When combined with potential impacts of potash mining, residential and commercial development, and other new sources of economic stimulus, the no-action alternative would have long-term, minor to moderate, beneficial cumulative impacts on the socioeconomic environment.

ALTERNATIVE B (NPS PREFERRED ALTERNATIVE)

Alternative B describes the new management approach to be taken in the wilderness areas. Over time, the National Park Service would seek to provide new and enhanced visitor opportunities in the wilderness areas, but such opportunities would be made available only if the risk of resource damage and adverse effects on wilderness character could be minimized. Increased visitor accessibility and opportunities would likely stimulate a minimal increase in park visitation and therefore increase both local spending in nearby communities and corresponding sales tax receipts. However, overall visitation levels would continue to be driven largely by unrelated economic conditions.

The only new development proposed in the action alternative is a trail through the backcountry and two new formalized access points. These developments may require the use of a local contractor for construction, which would temporarily benefit the local economy. There will also be nonfacility costs to conduct resource inventories, condition assessments, resource mapping, and development of educational and interpretive programs and materials. A percentage of these nonfacility costs would be spent by people coming to the park/local area to conduct these inventories and assessments, which would temporarily benefit the local economy through additional spending and tax receipts from food and lodging. Also, to adequately monitor, inventory, and manage the wilderness areas, the action alternative would increase the annual operating budget of the park, which would likely increase expenditures in the local and regional economy as a result of expanded operations.

Under the action alternative, park visitation and corresponding visitor spending and sales tax receipts would be expected to increase. Park operations would be expanded, however, park staff levels would not change. Therefore the action alternative would have a minor, long-term, beneficial impact on the local and regional economy.

Cumulative Impacts. Overall, the effects on the socioeconomic environment of the two counties from implementing the action alternative would be the same as those described for the no-action alternative—long term, minor to moderate, and beneficial.

Combining the likely effects of implementing the action alternative with the effects of other reasonably foreseeable future actions, there would be long-term, minor to moderate, and beneficial cumulative impacts. The action alternative would contribute a small increment to this cumulative impact.

Conclusion. Alternative B would have minor, long-term, beneficial effects on the socioeconomic environment as a result of an increase in park spending as well as an increase in visitor spending. When combined with the potential impacts of potash mining, residential and commercial development, and other new sources of economic stimulus, the action alternative would have a long-term, minor to moderate, beneficial cumulative impact on the local and regional economy. The action alternative would contribute a small increment to this cumulative impact.



PUBLIC INVOLVEMENT

Public involvement for this planning effort began during the scoping phase, which is an early and open process requesting the public to submit comments, concerns, and suggestions relating to the scope of the project and preliminary issues.

As part of public scoping for the planning effort, 300 newsletters were mailed to stakeholders in June 2011. Additional copies of the newsletter were available for the visiting public at visitor and contact centers, and it was also posted on the project's website (http://parkplanning.nps.gov/pefowsp). The newsletter provided notification of the commencement of the planning process and identified the following elements of the Wilderness Stewardship Plan:

- purpose of the plan
- relationship to other park plans
- key components of the plan (i.e., wilderness character and the foundation for wilderness planning; baseline condition assessment; indicators, measures, and standards; and management actions)
- defining qualities contributing to wilderness character
- preliminary assessment of wilderness issues and opportunities
- planning schedule identifying milestones and opportunities for public input

A mail-back comment form was included with the newsletter, which provided an opportunity for respondents to inform the NPS planning team of their activities and experiences in the park's wilderness areas; their assessment of issues regarding the protection of park wilderness character; recommendations for desired wilderness conditions and visitor opportunities; and other relevant issues and topics. Respondents were encouraged to complete the form on the project website. The public comment period extended from late June to the end of July 2011. No public meetings were held as part of the scoping process.

Three public comments were received by the park during scoping. The following issues and concerns were among those submitted by commenters:

- continue no signs in wilderness
- protect the night sky
- park should work with neighbors and carry out community outreach
- address visitor use issues and impacts
- institute a permit system to address access
- continue trails in wilderness
- address human waste management
- educate the public about resource impacts and vandalism
- protect wilderness from outside development threats
- address climate change
- keep boundary fencing to a minimum
- conduct scientific research on foot and with hand tools

Internal scoping included participation from Petrified Forest National Park, the NPS Denver Service Center, and the NPS Intermountain Regional Office. The planning team initially conducted a workshop held March 29–31, 2011, at park headquarters. The core elements of the plan were developed for subsequent use in shaping management alternatives. The team gathered pertinent information about park-designated wilderness areas (e.g., legislation, maps, relationship to other plans); drafted narrative descriptions of

park wilderness qualities; developed indicators, measures, and data sources for assessing current wilderness area conditions, trends, issues, threats, and desired conditions; and discussed potential management strategies to ensure protection of wilderness qualities.

An additional NPS planning team workshop was held August 9–11, 2011, at the park to develop alternatives for the restoration, protection, and enhancement of park wilderness character. Workshop planners focused on developing and refining goals and objectives, desired future conditions, a user capacity strategy, and a wilderness character monitoring framework. Management zones previously developed for the *General Management Plan Revision* (2004) were reviewed for potential adoption for wilderness area management. The zone description provided in the *General Management Plan Revision* for the preservation emphasis zone was determined to best apply to park wilderness areas.

CONSULTATION AND COORDINATION WITH OTHER AGENCIES, OFFICES, AND ASSOCIATED TRIBES

Consultation with federal and state agencies and American Indian tribes for the Wilderness Stewardship Plan was initiated by the National Park Service in 2011. Scanned copies of letters received from other agencies, offices, and associated tribes is included in the appendixes.

Consultation with the U.S. Fish and Wildlife Service and Arizona Game and Fish Department

Petrified Forest National Park initiated informal consultation with the U.S. Fish and Wildlife Service in a letter dated June 27, 2011, notifying the U.S. Fish and Wildlife Service that it was beginning the Wilderness Stewardship Plan. The Endangered Species Act of 1973, as amended, requires in section 7 (a) (2) that each federal agency, in consultation with the Secretary of the Interior, ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The park requested a current list of federally listed plant and animal species, and any designated critical habitat for such species that might occur within park wilderness areas. The U.S. Fish and Wildlife Service responded in a letter dated August 31, 2011, referring the park to the Arizona Ecological Service Field Office listing by county of endangered, threatened, proposed, and candidate species.

Petrified Forest National Park notified the Arizona Game and Fish Department that it was beginning the Wilderness Stewardship Plan in a letter date June 27, 2011. The National Park Service requested a current list of state-listed or other special status species that might occur within the designated wilderness areas of the park.

The information provided by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department was used to develop the list of special status species found in "Chapter 3: Affected Environment."

The U.S. Fish and Wildlife Service and the Arizona Game and Fish Department were also sent copies of the scoping newsletter, and a copy of this draft document has been be sent to them for their review.

CONSULTATION WITH TRADITIONALLY ASSOCIATED TRIBES

In letters dated November 17, 2011, the park notified various offices of the Hopi Tribe, the Pueblo of Zuni, and the Navajo Nation that it had begun preparation of the Wilderness Stewardship Plan. The tribes were invited to consult and participate in the planning process on a government-to-government basis. Consultation with American Indian

tribes is carried out in accordance with various federal laws, executive orders, regulations, and policies (e.g., Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," 2000; Executive Order 13007, "Indian Sacred Sites," 1996; section 106 of the National Historic Preservation Act of 1966, as amended).

Tribal representatives met with park staff and concurred with NPS management efforts to keep the wilderness area as pristine as possible. The protection of archeological resources was of particular concern to the tribal representatives. They also encouraged the park to monitor resource conditions and to undertake suitable measures to prevent resource damage and unauthorized access into wilderness.

Copies of the Wilderness Stewardship Plan will be sent to each associated tribe for review and comment. Tribes will have opportunities to identify any subsequent issues or concerns, and the park will continue to consult during preparation/implementation of the plan and as part of its ongoing commitment to maintain open tribal / NPS communications. Information and recommendations conveyed to the park by associated tribes with regard to wilderness management or other concerns will be considered and addressed as appropriate, and the park will undertake measures to protect (and maintain traditional access to) culturally important resources and places.

SECTION 106 CONSULTATION WITH THE ARIZONA STATE HISTORIC PRESERVATION OFFICE

The park notified the Arizona SHPO of the commencement of the Wilderness Stewardship Plan in a letter dated June 27, 2011, and invited the SHPO to participate in the consultation and planning process to assist with the preservation management of cultural resources in the park's wilderness areas. A copy of this plan will be sent to the Arizona SHPO for review and comment. The park will consult with the SHPO in accordance with section 106 of the National Historic Preservation Act with regard to specific undertakings that may arise from the Wilderness Stewardship Plan to assess potential effects on cultural resources (particularly archeological and ethnographic resources) and to seek ways to avoid or limit adverse effects as necessary.

List of Agencies, Organization, and Individuals Receiving a Copy of This Document

Federal Agencies

Advisory Council on Historic Preservation
Natural Resources Conservation Service
- Holbrook Service Center
- Springerville Service Center

U.S. Department of the Interior
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office

U.S. Senators and Representatives

Honorable Jon Kyl, Senator
Honorable John McCain, Senator
Honorable Paul Gosar, Representative

State Agencies

Arizona Ecological Services Field Office
Arizona Game and Fish Department
Arizona State Historic Preservation Office
Arizona State Parks

State Officials

Honorable Jan Brewer, Governor
State Senator Steve Pierce
State Representative Karen Fann
State Representative Andy Tobin

American Indian Tribes Traditionally Associated With Park Lands

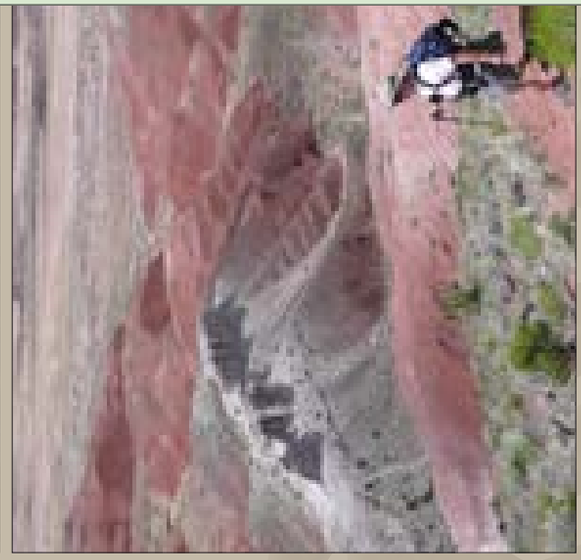
Hopi Tribe
- Cultural Preservation Office – Leigh J. Kuawanwisima
- Cultural Preservation Office – Lee Wayne Lomayestewa
- Cultural Preservation Office – Terry Morgart

Navajo Nation
- President – Ben Shelly
- Historic Preservation Department – Tim Begay
- Historic Preservation Department – Tony Joe
- Division of Natural Resources – Arvin Trujillo

Pueblo of Zuni
- Department of Natural Resources – Kurt Bemis
- Fish and Wildlife Dept. (Little Colorado River Program) – Fidel Lorenzo
- Zuni Cultural Resources Enterprise – Dr. Kurt Dongoske

Individuals

The list of individuals is available from park headquarters.


APPENDIX A: ENABLING LEGISLATION

Act of October 23, 1970, (84 Stat. 1105)

16. Petrified Forest

An Act to designate certain lands as wilderness. (84 Stat. 1105)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

* * * * * * *

DESIGNATION OF WILDERNESS AREAS WITHIN NATIONAL PARKS AND MONUMENTS

SEC. 2. In accordance with section 3(c) of the Wilderness Act (78 Stat. 890; 16 U.S.C. 1132(c)), the following lands are hereby designated as wilderness:

(a) certain lands in the Craters of the Moon National Monument, which comprise about forty-three thousand two hundred and forty-three acres and which are depicted on a map entitled "Wilderness Plan Craters of the Moon National Monument, Idaho," numbered 131–91,000 and dated March 1970, which shall be known as the "Craters of the Moon National Wilderness Area";

(b) certain lands in the Petrified Forest National Park, which comprise about fifty thousand two hundred and sixty acres and which are depicted on a map entitled "Recommended Wilderness, Petrified Forest National Park, Arizona", numbered NP–PF–3320–O and dated November 1967, which shall be known as the "Petrified Forest National Wilderness Area".

* * * * * * *

SEC. 4. As soon as practicable after this Act takes effect, a map and a legal description of each wilderness area shall be filed with the Interior and Insular Affairs Committee of the United States Senate and the House of Representatives, and such description shall have the same force and effect as if included in this Act: *Provided, however*, That correction of clerical and typographical errors in such legal description and map may be made.

SEC. 5. Wilderness areas designated by or pursuant to this Act shall be administered in accordance with the provisions of the Wilderness Act governing areas designated by that Act as wilderness areas, except that any reference in such provisions to the effective date of the Wilderness Act shall be deemed to be a reference to the effective date of this Act, and any reference to the Secretary of Agriculture shall be deemed to be a reference to the Secretary who has administrative jurisdiction over the area.

Approved October 23, 1970.

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APPENDIX B: REFERENCES

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APPENDIX D: MINIMUM REQUIREMENTS DECISION GUIDES

Appendix D includes three minimum requirements decision guides for Petrified Forest National Park. The first decision guide is a generic one, intended for individual specific proposed actions. Decisions are made on a case-by-case basis as indicated in the signature block. After this guide there are two programmatic decision guides for paleontological and archeological research, and boundary fence maintenance. The two programmatic decision guides will be authorized through the completion of the decision document for this environmental assessment and thus do not have signature blocks.

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEET

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

NOTE: The MRDG Instructions for filling out this guide may be found at:
http://www.wilderness.net/mrdg/

Project Title: _____

Step 1: Determine if any administrative action is necessary.

To determine if administrative action is necessary, answer the questions listed in A - F on the following pages by answering Yes, No, or Not Applicable and providing and explanation.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☐ **No:** ☐

Explain:

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows or requires consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes: ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: Untrammeled, Undeveloped, Natural, Outstanding opportunities for solitude or a primitive and unconfined type of recreation, or other unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Undeveloped: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Natural: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Other unique components that reflect the character of this wilderness:

Yes: ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to be consistent with one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Scenic: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Scientific: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Education: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Conservation: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Historical use: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☐

Explain:

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: ☐ **No:** ☐ **More information needed:** ☐

Explain:

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative # _____

Description:

Effects:

Wilderness Character
"Untrammeled"
"Undeveloped"
"Natural"
"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"
Other Features and Values

Other Criteria:

Maintaining Traditional Skills: Park use of non-mechanized tools and equipment would continue in the wilderness.

Special Provisions:

Economics and Timing Constraints:

Safety of Visitors, Personnel, and Contractors:

Comparison of Alternatives

It may be useful to compare each alternative's benefits and adverse effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

The relative beneficial or adverse effects of the alternative decision criteria can be presented in the following table according to whether they would have minor beneficial or adverse effects (+,-), multiple or greater than minor beneficial or adverse effects (++, --), no effect (N/E), or are not applicable (N/A).

Untrammeled				
Undeveloped				
Natural				
Solitude or Primitive Recreation				
Other Features and Values				

Maintaining Traditional Skills				
Special Provisions				
Economics & Timing				

Safety Criterion

Occasionally, safety concerns can legitimately dictate choosing one alternative which degrades wilderness character (or other criteria) more than an otherwise preferable alternative. In that case, describe the benefits and adverse effects in terms of risks to the public and workers for each alternative here but avoid pre-selecting an alternative based on the safety criteria in this section.

	Alternative A	Alternative B	Alternative C	No Action
SAFETY (PUBLIC AND WORKERS)				

Documentation:

To support the evaluation of alternatives, provide an analysis, reference, or documentation and avoid assumptions about risks and the potential for accidents. This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.

Information used to select the preferred alternative was based on the best professional opinion of NPS and park staff.

Step 2 Decision: What is the Minimum Activity?

Rationale for selecting this alternative (including safety criterion, if appropriate):

Monitoring and reporting requirements:

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☐ mechanical transport
- ☐ motorized equipment
- ☐ motor vehicles
- ☐ motorboats
- ☐ landing of aircraft
- ☐ temporary road
- ☐ structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:				
Recommended:				
Recommended:				
Approved:				

Excavation and/or Removal of Paleontological Specimens Collected During Research Efforts, and Archeological Data Recovery

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

Project Title: Excavation and/or Removal of Paleontological Specimens Collected During Research Efforts, and Archeological Data Recovery

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

This programmatic minimum requirements decision guide addresses the excavation and removal of specimens/artifacts that are discovered during paleontological and archeological research within the Petrified Forest National Park wilderness area. With regard to paleontological research, the decision guide only applies to specimens that are too fragile or heavy to excavate and remove without using section 4(c) prohibited uses. For example, fossils are often preserved in large plaster jackets that can weigh hundreds of pounds. In addition, the removal of especially fragile specimens from encasing rock using hand tool methods can cause excessive vibration that can damage or destroy specimens. The decision guide also applies to methods of archeological research that may require the excavation and removal of cultural artifacts and other materials that cannot be adequately preserved *in situ*. This programmatic document will sunset December 31, 2018.

To determine if administrative action is necessary, answer the questions listed in A–F on the following pages by answering Yes, No, or Not Applicable and providing an explanation.

A. Describe Options Outside of Wilderness
Is action necessary within wilderness?

Yes: X **No:**

Explain: This minimum requirements decision guide applies only to those specimens and archeological sites that are within wilderness and require controlled excavation and removal for research and preservation purposes.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows or requires consideration of the section 4(c) prohibited uses? Cite law and section.

Yes: **No: X** **Not Applicable:**

Explain: No special provisions apply to this action in the park's wilderness legislation.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: X **No:** **Not Applicable:**

Explain: The park's enabling legislation states that scientific research is part of the park's purpose. (See park's foundation statement for more information.) The *National Historic Preservation Act, Archeological Resources Protection Act*, and other laws and policies provide for the identification and protection of archeological resources.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments, or other federal agencies?

Yes: X **No:** **Not Applicable:**

Explain: Paleontological resources are susceptible to rapid deterioration when exposed to natural erosional processes. D.O. 77 states that exposed resources should be protected by a variety of measures including stabilization and reburial (a temporary or interim measure), the placement of protective structures or shelters over the resources, and partial or complete removal of specimens for transport to a facility providing long-term intensive management under appropriate curatorial conditions.

Archeological resources are managed in accordance with NPS policies and guidelines (e.g., *the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; D.O. 28A "Archeology"*). Although it is preferable to preserve and stabilize archeological sites undisturbed and *in situ,* sites that are subject to disturbance due to erosion or other factors may require that data recovery excavations or other appropriate mitigation be conducted to recover as much important information from the site as possible before it is irretrievably lost.

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: Untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or other unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** **No: X** **Not Applicable:**

Explain: The Wilderness Act states that among their many purposes, "wilderness areas shall be devoted to the public purposes of … scientific … use." Although research is not necessary to preserve wilderness character, it is necessary to fulfill the purpose of the park. Research, collection, and mitigation activities, while likely to have short-term, localized impacts on the untrammeled nature of the wilderness area, would be conducted in a manner that does not degrade wilderness values or leave lasting evidence of human activities.

Undeveloped: **Yes:** **No: X** **Not Applicable:**

Explain: Although protective shelters provide a method of preserving exposed paleontological resources, the construction of such shelters at Petrified Forest NP would be incompatible with the undeveloped qualities of the wilderness area and would visually intrude on the landscape.

Natural: **Yes:** **No: X** **Not Applicable:**

Explain: The park's wilderness ecosystems are shaped by the dynamic forces of wind and water erosion. Although these erosional processes threaten and occasionally expose paleontological and archeological resources, undertaking measures to arrest or impede these processes to protect resources would be counter to the principles of preserving the natural qualities of wilderness.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: **No: X** **Not Applicable:**

Explain: Research and mitigation activities could potentially intrude on opportunities for visitors to experience solitude, natural sights and sounds, and other wilderness recreational qualities if they encountered research activities. However, these activities would be localized and short term, and consequently would be unlikely to substantially diminish wilderness recreational opportunities or impede visitor access to other areas within the wilderness.

Other features and values (including archeological and paleontological resources):

Yes: X **No:** **Not Applicable:**

Explain: The Wilderness Act states that a wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." This fifth quality, unlike the other four, is unique to Petrified Forest National Park wilderness based on the features that are inside the wilderness (NPS 2012). Paleontological resources and archeological resources clearly fit within this fifth quality of wilderness character because they are tangible features that have scientific, educational, scenic, or historical value. This quality would be degraded by deterioration or loss of archeological resources and paleontological resources integral to wilderness character.

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to be consistent with one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** **No:** **X** **Not Applicable:**

Explain: As noted above, other than potential short-term, isolated encounters visitors may have with researchers and their activities, these encounters would not substantially diminish or impede public recreational uses of the wilderness.

Scenic: **Yes:** **No:** **X** **Not Applicable:**

Explain: Research and mitigation activities may introduce short-term visual intrusions on the wilderness landscape as a result of research teams concentrated at particular site locations to carry out excavation or data recovery. These activities would not result in lasting degradation of wilderness scenic qualities as experienced by park visitors.

Scientific: **Yes:** **X** **No:** **Not Applicable:**

Explain: Globally significant, Late Triassic paleontological resources and nationally significant archeological sites exist within the wilderness. A purpose of the park is to foster scientific research of these unique resources.

Education: **Yes:** **X** **No:** **Not Applicable:**

Explain: Paleontological and archeological resources found throughout the wilderness are integral to the park's mission to provide for greater public understanding and appreciation of these significant resources.

Conservation: **Yes:** **X** **No:** **Not Applicable:**

Explain: Removal of exposed paleontological specimens, archeological resources, and associated contextual information is often necessary for long-term preservation and ongoing research in a museum or curatorial facility.

Historical use: **Yes:** **X** **No:** **Not Applicable:**

Explain: Information gathered from archeological investigations and research within the wilderness would continue to expand public understanding of prehistoric activities and adaptations to the environment in this portion of the desert Southwest. Visitors would continue to have opportunities to view petroglyphs and other sites, although the locations of sensitive sites would not be made public. The park would monitor sites to ensure that adverse visitor use impacts (e.g., looting, vandalism, erosion from social trails) are avoided or minimized. Tribal access would be maintained to potential ethnographic resources and sacred sites in conformance with NPS and wilderness management policies.

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: **X** **No:** **More information needed:**

Explain: Action is required due to the occurrence of paleontological specimens and archeological resources in wilderness. Failure to remove exposed specimens or conduct archeological mitigation (e.g., data recovery) of threatened sites results in the irreparable destruction and loss of specimens, artifacts, and scientific data.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying MRDG *Instructions* for information on identifying alternatives and an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative 1 **No Action**

Description: Protective management of exposed paleontological specimens and archeological sites would not occur, and specimens and sites would not be collected or recovered.

Effects: Other features (paleontological and archeological) and values and scientific data would be diminished or lost as sites deteriorate due to weathering and erosion.

Wilderness Character:

"Untrammeled" – The wilderness would continue to be largely unaffected by human activities and manipulation of the environment.

"Undeveloped" – The wilderness would remain undeveloped without conspicuous evidence of structures or other constructed features.

"Natural" – Natural processes and ecosystem functions would continue unimpeded by human intervention.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Visitors to the wilderness would continue to have opportunities for appropriate wilderness recreational activities and experiences.

"Other Features and Values" - Protective management of exposed paleontological specimens and archeological sites would not occur, allowing this quality of wilderness to be degraded. Cultural and archeological resources would continue to be managed in accordance with NPS policies and guidelines with particular regard to identification, monitoring and preservation / stabilization. The park would strive to manage late Triassic paleontological resources in accordance with NPS policy. However, lack of a consistent programmatic strategy for the collection or recovery of exposed specimens in wilderness would continue to place these resources at risk of loss or deterioration due to weathering and erosion.

Other Criteria:

Maintaining Traditional Skills – Park use of non-mechanized tools and equipment would continue in the wilderness.

Special Provisions – N/A

Economics and Timing Constraints – N/A

Safety of Visitors, Personnel, and Contractors – Visitor and personnel safety in the wilderness would continue to be addressed through safety guidelines and customary delivery of park educational and interpretive information at the visitor center or by ranger contact.

Alternative 2 **Collection, removal and data-recovery using nonprohibited methods**

Description: Paleontological specimens and archeological resources would be excavated using only hand tools and removed without wheeled conveyances.

Effects:

Wilderness Character

"Untrammeled" – Dragging or packing resources out of the wilderness without the use of wheeled conveyances would likely adversely impact the land surface, soils and vegetation. Ground disturbance could accelerate erosion and result in more long-term evidence of human activities that diminish the untrammeled nature of wilderness.

"Undeveloped" – Use of non-prohibited research methods would not adversely impact the undeveloped qualities of the wilderness.

"Natural" – Dragging or packing resources out of the wilderness could adversely impact native plant communities, accelerate erosion, and contribute to the disturbance of natural ecosystem processes.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Use of noprohibited research methods would likely entail longer periods during which field excavations are conducted, require more work crew members, and/or result in prolonged associated noise impacts. These factors could negatively affect the wilderness experience for visitors near research locations.

"Other Features and Values" - Protective management of exposed paleontological specimens and archeological sites would occur with hand tools and without wheeled conveyances, allowing small specimens to be carried out and protected and large specimens to be minimally protected where possible. This alternative presents a greater potential for damage to fragile archeological resources collected during data recovery excavations and transported out of the wilderness by non-wheeled conveyance. Dragging or packing resources and research equipment could also lead to erosion that could adversely impact other unidentified archeological sites. The park would strive to manage late Triassic paleontological resources in accordance with NPS policy. However, the restrictions placed on the use of mechanized tools for excavation and wheeled conveyances for specimen removal would place these resources at risk of damage or deterioration if excavation could not be accomplished in a timely manner, and/or if resources were required to be dragged or packed out of the wilderness over uneven or difficult desert terrain.

Other Criteria:

Maintaining Traditional Skills – NPS / park use of nonmotorized tools and equipment would continue, and the NPS would foster the skills necessary to conduct research in the wilderness. These skills would be imparted to researchers and investigators through appropriate training and educational programs.

Special Provisions – N/A

Economics and Timing Constraints: The use of non-motorized tools and equipment could require that investigations utilize larger numbers of crew members for longer periods. This could entail greater associated expenses and potential difficulties procuring the services of those having the requisite specialized skills.

Safety of Visitors, Personnel, and Contractors - More people would be required to work at constrained excavation sites for longer periods because of the restricted use of wheeled / motorized conveyances and mechanical tools. This would present an increased risk for injury or heat-related ailments because of adverse desert conditions. It could also be more difficult to evacuate individuals from the work site in a timely manner.

Alternative 3 **Collection and removal using only limited prohibited methods**

Description: This alternative would permit a minimal use of hand-held power tools to excavate paleontological specimens. Archeological investigations could use remote-sensing devices such as ground penetrating radar. Nonmotorized wheeled conveyances could be used for removal of paleontological specimens and recovered archeological resources. The size and weight of specimens and their location may require the use of additional prohibited methods. If a nonmotorized wheeled conveyance does not adequately permit specimen removal, an all-terrain / utility vehicle, or motorized wheel barrow may be used in dry washes for transport. In extreme cases when the specimen is particularly heavy, the use of a truck may be required in dry washes. The use of a helicopter may be required when the specimen is exceptionally heavy and located in an area inaccessible to a wheeled vehicle. Use of a vehicle in a dry wash is preferred because water run-off in the washes more easily erases evidence of vehicle tracks.

Effects:

Wilderness Character

"Untrammeled" – Limited use of mechanical tools and vehicles would slightly diminish the untrammeled nature of the wilderness. Selective use of these tools would moderately reduce the duration of research activities, and measures such as placement of access routes along dry washes would assist efforts to minimize or mitigate the adverse impacts on wilderness character.

"Undeveloped" – The undeveloped nature of the wilderness would remain, and no permanent roads or other structures would be built.

"Natural" – The natural qualities of wilderness would be preserved and disruptions to natural processes would be minimized to the extent possible. There would be no lasting traces of research activities or transport of collected specimens.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Visitors could experience short-term disruptions to solitude and unconfined types of recreation from encounters with researchers and the associated visual and audible intrusions of research activities. However, these encounters would be infrequent, localized, and of limited duration because of the accelerated nature of research investigations permitted by a minimal use of mechanical tools and methods.

"Other Features and Values" – Collection and removal of paleontological or archeological specimens using limited prohibited methods would allow for a higher level of protection of these resources due to the improved ability to remove these resources when necessary for protection. Use of nonmotorized or motorized wheeled conveyances to transport archeological resources would lessen the possibility of damage during transport compared to dragging or packing out collected materials. Data recovery methods would continue to rely primarily on controlled manual excavations. The park would strive to manage late Triassic paleontological resources in accordance with NPS policy. The limited use of prohibited methods for the excavation and transport of specimens would provide greater assurance that these resources are excavated, protected and transported out of the wilderness in a timely manner before they deteriorate or erode.

Other Criteria:

Maintaining Traditional Skills – Selective or limited NPS / park use of mechanical tools and equipment would assist, but not entirely eliminate, the use of traditional (nonmechanical) research skills and methods. The National Park Service would continue to foster the skills necessary to conduct research in the wilderness, and these skills would be imparted to researchers and investigators through appropriate training and educational programs.

Special Provisions – N/A

Economics and Timing Constraints - The limited use of mechanical tools and equipment could reduce the size of research crews and the time required for them to carry out investigations and remove specimens. This could correspondingly reduce the expense of research excavations and lessen the potential difficulties of procuring specialized services.

Safety of Visitors, Personnel, and Contractors – Potentially fewer people would be required to work at excavation sites because of the assistance provided by the limited use of mechanical tools and nonmotorized wheeled conveyances. The length of time required for research activities would also be reduced. This would help reduce the risk of injury and heat-related ailments associated with working in adverse desert conditions.

Alternative 4 **Collection and removal using prohibited methods**

Description: This alternative would allow the use of motorized heavy equipment (such as backhoes) for excavation and the use of motorized vehicles. Temporary roads could be constructed outside of dry washes for specimen removal. Special regard would be given to topography and vegetation to protect fragile resources.

Effects:

Wilderness Character

"Untrammeled" – The use of motorized / mechanical tools, heavy equipment and vehicles would substantially diminish the untrammeled nature of the wilderness. Although the use of such tools and equipment would markedly reduce the duration of research activities, it would be more likely to leave lasting evidence of these activities on the desert landscape.

"Undeveloped" – Localized adverse impacts to the undeveloped nature of the wilderness would occur with the potential construction of temporary roads and other support facilities (e.g., storage tanks, staging areas). Although temporary (lasting only as long as the research/excavation activities) evidence of construction and development would likely remain for an extended period because of the fragile nature of the desert environment.

"Natural" – The natural qualities of the wilderness would be preserved to the extent possible and disruptions to natural processes would be minimized through best management practices and appropriate mitigation. However, there would be an increased risk for the use of heavy equipment to accelerate erosion and disturb vegetation, soils, and ecological processes. There would also be pollution concerns associated with vehicle emissions and potential fuel/oil spills.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Visitors could experience short-term disruptions to solitude and unconfined types of recreation from encounters with researchers and the increased visual and audible intrusions of heavy equipment and motorized vehicles. Although these encounters would be infrequent, localized, and of limited duration, they may be more noticeable and intrusive over longer distances because of the nature and intensity of impacts associated with the equipment used.

"Other Features and Values" – Collection and removal of paleontological or archeological specimens using prohibited methods would allow for the highest level of protection of these resources due to the improved ability to remove the resources when necessary. However, this method is the most likely to impact the other four qualities of wilderness character. Use of motorized vehicles to transport excavated archeological resources would lessen the potential for resource damage during transit. However, the use and transport of heavy equipment, and the need to construct temporary roads, presents a risk of inadvertent damage and erosion to unidentified archeological resources. Archeological data recovery methods would continue to rely primarily on controlled manual excavations. The park would strive to manage late Triassic paleontological resources in accordance with NPS policy. The use of prohibited methods for excavation of specimens and the development of temporary roads for access and transport would help ensure that resources are excavated, protected and transported out of the wilderness in a timely manner before they deteriorate or erode. However, because the effectiveness and/or appropriateness of heavy equipment could be limited in particular instances, researchers and excavators would continue to employ limited power tools and manual methods as necessary.

Other Criteria:

Maintaining Traditional Skills – Use of motorized/mechanical tools and equipment would assist (but would not entirely eliminate) the use of traditional or nonmechanical research skills and methods. The NPS would continue to foster the skills necessary to conduct research in the wilderness, and these

skills would be imparted to researchers and investigators through appropriate training and educational programs.

Special Provisions – N/A

Economics and Timing Constraints – The use of motorized / mechanical tools and heavy equipment could reduce the size of research crews and the time required for them to carry out investigations and remove specimens. Although this could reduce the expense of research excavations, the additional expenses associated with procuring and operating mechanical tools and heavy equipment could offset potential cost savings.

Safety of Visitors, Personnel, and Contractors - Potentially fewer people would be required to work at excavation sites because of the assistance provided by the use of mechanical tools and heavy equipment. The length of time required for research activities would also be reduced. Although this would generally help reduce the risk of injury and heat-related ailments associated with working in adverse desert conditions, there would be an increased risk of injury from working in proximity to heavy equipment.

Comparison of Alternatives

It may be useful to compare each alternative's benefits and adverse effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

The relative beneficial or adverse effects of the alternative decision criteria are presented in the following table according to whether they would have minor beneficial or adverse effects (+, -), multiple or greater than minor beneficial or adverse effects (++, --), no effect (N/E), or are not applicable (N/A):

	No-Action	Alternative 2	Alternative 3	Alternative 4
Untrammeled	N/E	--	-	--
Undeveloped	N/E	N/E	N/E	-
Natural	N/E	--	-	--
Solitude or Primitive Recreation	N/E	-	-	--
Other Features and Values	--	--	++	++
WILDERNESS CHARACTER	- 2	- 7	- 1	-5

Maintaining Traditional Skills	+	+	+	+
Special Provisions	N/A	N/A	N/A	N/A
Economics & Timing	N/A	--	+	-

	No-Action	Alternative 2	Alternative 3	Alternative 4
SAFETY (PUBLIC AND WORKERS)	Neutral	- 2	- 1	- 1

Safety Criterion

Occasionally, safety concerns can legitimately dictate choosing one alternative that degrades wilderness character (or other criteria) more than an otherwise preferable alternative. In that case, describe the benefits and adverse effects in terms of risks to the public and workers for each alternative here but avoid pre-selecting an alternative based on the safety criteria in this section.

Documentation

[To support the evaluation of alternatives, provide an analysis, reference, or documentation and avoid assumptions about risks and the potential for accidents. This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.]

Information used to select the preferred alternative was based on the best professional opinions of NPS and park staff.

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG *Instructions* before describing the selected alternative and describing the rationale for selection.

Selected alternative: 3

Rationale for selecting this alternative (including safety criterion, if appropriate):

Alternative 3 was determined to best address the criteria for preserving the qualities contributing to Petrified Forest National Park's wilderness character, as well as the public purposes for its wilderness areas (particularly the protection of scientific values). The alternative would permit a limited use of wilderness-prohibited tools and methods to excavate and transport paleontological specimens and conduct archeological data recovery. Because it is often necessary to expedite research excavations and transport exposed specimens out of the wilderness in a timely manner to minimize the damaging effects of erosion and natural deterioration, it was considered appropriate to allow the limited use of hand-held

power tools, mechanical survey equipment and the selective use of wheeled conveyances for the transport of specimens and artifacts. Alternative 3 also allows for the limited use of motorized all-terrain utility vehicles, trucks and helicopters to transport specimens determined too heavy to move by nonmotorized conveyances. These methods would only be authorized after a thorough evaluation of the minimal tool or method necessary to adequately conduct excavations and transport.

The limited use of mechanical tools and vehicles would be expected to slightly diminish the untrammeled nature of wilderness areas, with no substantial or lasting evidence of research activities to mar the undeveloped and natural qualities of wilderness. No permanent roads or structures would be built, and the adverse impacts associated with research and specimen transport would be minimized by such means as using dry washes for transport routes. Visitor encounters with research activities could result in short-term disruptions to their experience of solitude and other recreational wilderness attributes. Such encounters, however, would be infrequent, localized, and of limited duration. This alternative would allow for the greatest protection of other wilderness features and values (archeological and paleontological resources) while also minimizing the impacts to the other four qualities of wilderness character.

Alternative 3 was determined to reduce the possibility of damage to specimens and archeological resources that might otherwise occur from the use of nonmechanized means of transport across rugged desert terrain. The limited use of mechanical tools and equipment could also facilitate research investigations, reducing the size of work crews and the time required for them to carry out investigations and remove specimens. This could also reduce the costs associated with research excavations and transport.

The National Park Service would continue to foster the skills necessary to conduct research in the wilderness, and these skills would be imparted to researchers and investigators through appropriate training and educational programs to minimize wilderness impacts. Potentially fewer people would be required to work at excavation sites due to the assistance provided by the limited use of mechanical tools and equipment, and the risk of injury and heat-related ailments associated with working in adverse desert conditions would also be correspondingly reduced.

Monitoring and reporting requirements:

All paleontological and archeological research activities and excavations would be evaluated to ensure that they are conducted in accordance with the protection of wilderness qualities and values. Monitoring would occur during research activities to ensure compliance with all applicable laws and policies, and subsequent long-term monitoring would ensure that no lasting evidence of research excavations and transport of specimens remain to degrade wilderness qualities. Should monitoring reveal evidence of diminished wilderness conditions, appropriate mitigation or adaptive management strategies would be implemented to promote the recovery of wilderness qualities and values.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☒ Mechanical transport
- ☒ Motorized equipment
- ☒ Motor vehicles
- ☐ Motorboats
- ☐ Landing of aircraft
- ☐ Temporary road
- ☐ Structure or installation

Maintenance of the Wilderness Boundary Fence

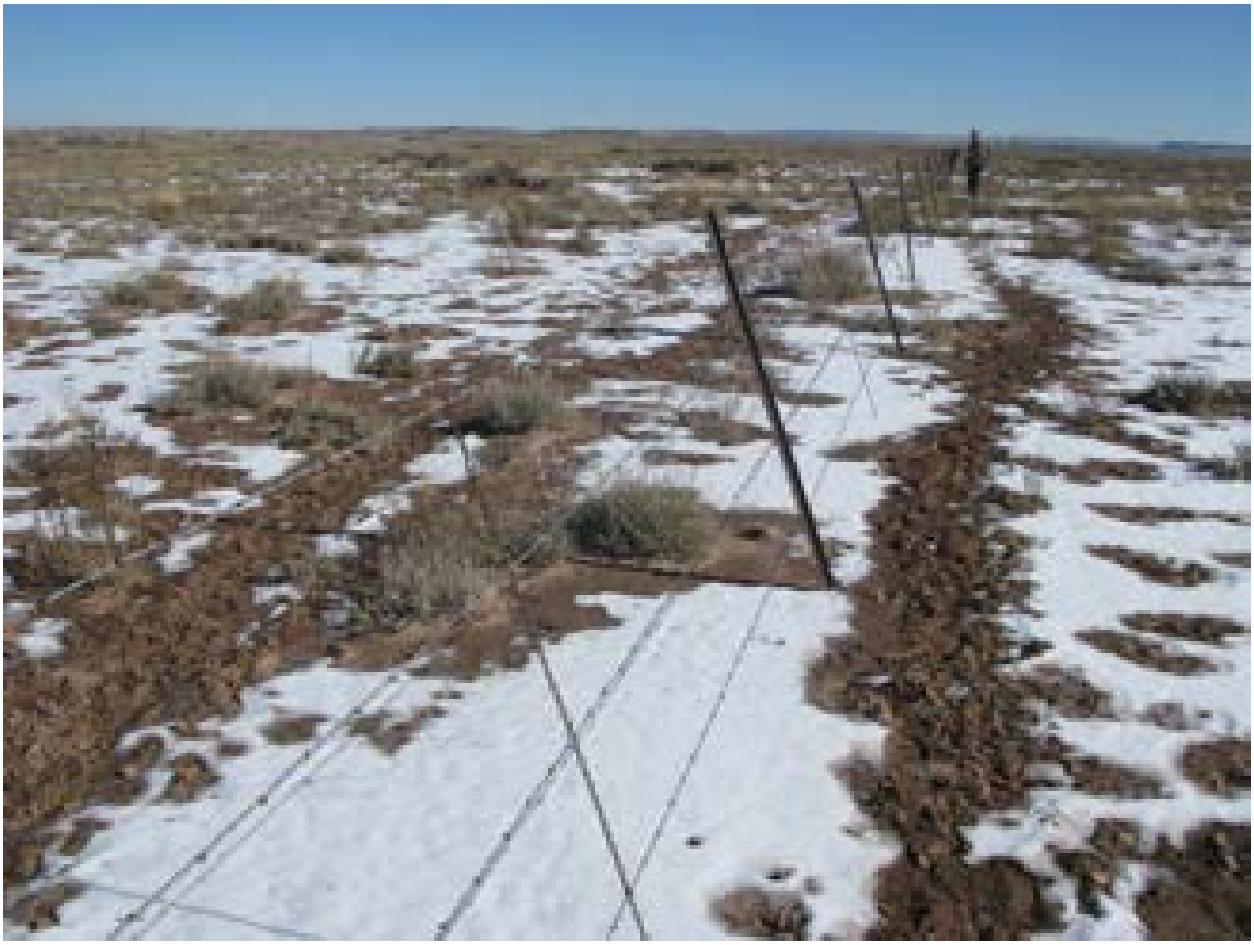
ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS
DECISION GUIDE

WORKSHEETS

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964



Project Title: Maintenance of the wilderness boundary fence

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

This is a programmatic minimum requirments decision guide for the maintenance of wilderness boundary fences, and will sunset December 31, 2018. This analysis will be evaluated annually to ensure that actions are still required to maintain fencing, and thus protect wilderness character. It is necessary to maintain the wilderness boundary fence to protect wilderness character and the four wilderness qualities. The fence prevents the entrance of livestock and ATV trespass.

To determine if administrative action is necessary, answer the questions listed in A–F on the following pages by answering Yes, No, or Not Applicable and providing and explanation.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: **X** **No:**

Explain: The boundary fence is inside of wilderness property, so maintenance must occur within wilderness. However, access could be obtained through neighboring properties. This would require obtaining permission and maintaining relationships with neighbors in order to access wilderness via private property. Currently, permission to access wilderness through private lands has not been granted.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows or requires consideration of the section 4(c) prohibited uses? Cite law and section.

Yes: **No:** **X** **Not Applicable:**

Explain: No special provisions apply to this action in the park's wilderness legislation.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: **X** **No:** **Not Applicable:**

Explain: National Park Service is required to preserve and protect the resources in our care. 36CFR 1,5(f) and 1.7 (a)(1) require the park to inform people when they are entering federal property, and this information is posted on the fenceline. The wilderness boundary is also the park boundary. Therefore, the signs need to be posted on the park / wilderness property. The signs cannot be placed outside of the boundary because the land does not belong to the National Park Service.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state, and local governments or other federal agencies?

Yes: **X** **No:** **Not Applicable:**

Explain: Arizona law requires that livestock should be fenced out, not for owners to fence livestock in. The fence helps to keep livestock out of the wilderness area. It preserves the untrammeled nature, solitude, and wild experience of the park. Trespass livestock may damage resources such as springs, and trample archeological and paleontological sites.

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: Untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or other unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** **X** **No:** **Not Applicable:**

Explain: Trespass cattle and recreational vehicles disturb the natural quality of the wilderness because they represent effects of modern civilization on the natural ecological systems. The fence is necessary to prevent disturbances from trespass cattle and recreational vehicles.

Undeveloped: **Yes:** **No: X** **Not Applicable:**

Explain: Boundary fence maintenance is not necessary to preserve the undeveloped wilderness quality. The maintenance of boundary fence would be compatible with the undeveloped quality to the greatest extent possible.

Natural: **Yes:** **X** **No:** **Not Applicable:**

Explain: The incursion of trespass livestock and vehicles disturb soils, vegetation, wildlife, and alter natural water flows. The fence is necessary to prevent disturbances from trespass cattle and recreational vehicles.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: **X** **No:** **Not Applicable:**

Explain: Trespass livestock and vehicle disturb visitors' outstanding opportunities for solitude or a primitive type of recreation. The fence is necessary to prevent disturbances from trespass cattle and recreational vehicles.

Other features and values (including archeological and paleontological resources):

Yes: X **No:** **Not Applicable:**

Explain: Boundary fence maintenance is necessary to help preserve archeological or paleontological resources in the wilderness. The maintenance of the boundary fence would prevent trespass cattle or vehicles from inadvertently damaging fragile paleontological or archeological resources.

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to be consistent with one or more of the public purposes for wilderness (as stated in section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** **X** **No:** **Not Applicable:**

Explain: Maintaining and repairing the wilderness fence helps to preserve and protect the paleontological, archeological, and grassland areas of the park. These resources are important for visitor enjoyment and recreational experiences. Recreational activities could be disturbed by both cattle and ATV trespass.

Scenic: **Yes:** **X** **No:** **Not Applicable:**

Explain: The influence of intruding cattle, which are not a natural component of the landscape, can have an impact on the natural scenic value of the wilderness. Open vistas and rolling landscapes allow visitors to enjoy the scenic quality of the wilderness. The presence of trespass cattle could impact the visitor's ability to experience unimpeded viewsheds.

Scientific: **Yes:** **X** **No:** **Not Applicable:**

Explain: Science is one of the values of wilderness areas. The unmodified landscapes allow scientists an unparalleled opportunity to see ecosystems operating naturally. Maintaining the boundary fence prevents unnatural disturbances from cattle and ATVs, which could decrease the scientific value. The grassland areas of the wilderness have not been grazed in over 65 years and are particularly diverse in both flora and fauna. Trespass livestock and vehicles could damage or destroy fragile resources or result in the loss of these valuable resources.

Education: **Yes:** **No:** **X** **Not Applicable:**

Explain: Maintenance of the boundary fence would have no effect on education.

Conservation: **Yes:** **X** **No:** **Not Applicable:**

Explain: The fence protects natural resources from the impacts of trespass cattle and ATVs, and allows for conservation of the wilderness area into the future.

Historical use: **Yes:** **No:** **X** **Not Applicable:**

Explain: Maintenance of the boundary fence would have no effect on historical use.

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: **X** **No:** **More information needed:**

Explain: The fence needs to be repaired and replaced in numerous areas.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying MRDG *Instructions* for information on identifying alternatives and an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative 1 **No Action**

Description : In this alternative, the fence would not be repaired or replaced.

Effects: If the fence is not repaired / replaced, trespass livestock and ATVs will continue to enter the park and damage or destroy resources such as paleontological and archeological sites. Livestock can also impact the health and diversity of the grasslands. Without signpost on the fenceline, visitors would not know when they are in a national park because there would not be signs on the fenceline boundary.

Wilderness Character:

"Untrammeled" – The untrammeled nature of the area would be affected by trespass livestock and vehicles that can be seen or leave evidence of their passing.

"Undeveloped" – The undeveloped nature of the area would not be affected.

"Natural" – The natural quality of the area would be affected by trespass livestock and vehicles that can be seen or leave evidence of their passing.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – This quality would be affected by trespass livestock and vehicles that could disturb the primitive nature of the area. Even if they are not seen, they could leave tracks that show they have been there.

"Other features and values" - Paleontological and archeological resources could be damaged by trespass cattle or vehicles.

Other Criteria:

Maintaining Traditional Skills – N/A

Special Provisions – N/A

Economic and Time Constraints – N/A

Safety of Visitors, Personnel, and Contractors – Visitor and personnel safety in the wilderness would continue to be addressed through safety guidelines and customary delivery of park educational and interpretive information at the visitor center or by ranger contact.

Alternative 2 **Repair and replace breaks in the fence using non prohibited methods.**

(This would mean using humans or pack animals as a method for transporting the equipment necessary to repair breaks in the fence (this could be an internal operation or a contract with Navajo Nation [for example], using traditional stock).

Description:
In this alternative, people and pack animals would be used to carry the wire, posts, and the equipment needed to repair/replace the fence over several miles of rough terrain to the work site.

Effects: Maintaining the boundary fence would prevent the trespass of livestock and vehicles into the wilderness area. Using humans and stock for the maintenance of a fence would degradation of wilderness due to actions that intentionally manipulate or control ecological systems inside of wilderness. However, the presence of a fence itself could prevent the movement of native wildlife and effect several qualities of wilderness as described below.

"Untrammeled"– The untrammeled nature of the area could be affected. Maintaining a fence around the wilderness area could impede the natural movement of native ungulates (e.g., pronghorn) across the landscape. However, it would also prevent trespass vehicles and livestock therefore protecting the natural and solitude and primitive recreation qualities.

"Undeveloped"– The undeveloped nature of the area would be affected due to the presence and maintenance of a boundary fence. The presence of structures, such as stock fencing, degrades the undeveloped quality of wilderness.

"Natural"– The natural quality of wilderness could be affected by the presence and continued maintenance of a fence in wilderness. The maintained fence would degrade the natural quality of wilderness because it could impede natural movement of native ungulates (e.g., pronghorn).

However, it would prevent unnatural impacts to the grassland ecosystem due to cattle grazing and ATV trespass.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"– This quality could be affected due to the presence and maintenance of the wilderness fence, which could impede the visitor's perception of visual solitude on the landscape.

"Other features and values" – Paleontological and archeological resources would not be affected.

Other Criteria:

Maintaining Traditional Skills – Traditional skills and pack animals would be used for maintenance of the boundary fence.

Special Provisions – N/A

Economic and Time Constraints – Using pack animals and humans could cause time restraints due to long hours required in the field, and possibly safety concerns.

Safety of Visitors, Personnel, and Contractors – Safety could become an issue depending on the extent of the work that may need to be completed on the fence. Park staff or contractors may be required work prolonged hours exposed to the elements in order to complete fence repair. Extensive training and preparation for overnight pack trips may be required.

Alternative 3 **Repair and replace breaks in the fence using limited prohibited methods**

(This would mean using a minimally intrusive (visual and noise) type of mechanized vehicle (e.g., UTV) to transport the equipment necessary to repair breaks in the fence).

Description:
In this alternative, a UTV (utility task vehicle) would be used to carry personnel, wire, posts, and the equipment needed to repair/replace the fence over several miles of rough terrain to the work site. To the extent possible, the UTV would stay on the old road trace to prevent impacts on the vegetation. The vehicle would only make as many trips as necessary to bring equipment.

Effects:
Using a UTV would have short-term, minimal effects on the wilderness character. To minimize effects, the fence repair/replacement would occur in the early spring when there are few visitors in the wilderness area. Staff would check backcountry records to make sure people are not camping in the area. Maintaining the boundary fence would prevent the trespass of livestock and vehicles into the wilderness area. However, using a UTV for the maintenance of a fence would have some effect on wilderness due to the use of actions that intentionally manipulate or control ecological systems inside of wilderness, and could cause some visual and noise intrusions. Additionally, the presence of a fence itself could prevent the movement of native wildlife and could affect several qualities of wilderness as described below.

Wilderness Character:

"Untrammeled" – The untrammeled nature of the area would be temporarily and adversely affected. Maintaining a fence around the wilderness area could impede the natural movement of native ungulates (e.g., pronghorn) across the landscape. The use of a UTV would also affect the untrammeled quality because it is an action that represents modern human control and manipulation in the wilderness.

"Undeveloped" – The undeveloped nature of the area would be affected due to the presence and maintenance of a boundary fence. The presence of structures, such as stock fencing, degrades the undeveloped quality of wilderness. Additionally, the undeveloped nature would be temporarily adversely affected by the continued use of the old two-track roads within the wilderness area.

"Natural" – The natural quality of wilderness could be affected by the presence and continued maintenance of a fence in wilderness. The maintained fence would degrade the natural quality of wilderness because it could impede natural movement of native ungulates (e.g., pronghorn). The use of a UTV could also temporarily and adversely affect the natural quality of wilderness due to noise intrusions and possible soils impacts.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – This quality would be temporarily and adversely affected due to the presence of a UTV, which may reduce visitors' perception of solitude due to visual and noise intrusions caused by the presence of a UTV. However, the access point used for fence repair is rarely used by park visitors.

"Other features and values" – Paleontological and archeological resources would not be affected.

Other Criteria:

Maintaining Traditional Skills – N/A

Special Provisions – N/A

Economic and Time Constraints – Time constraints may occur due to the small size of UTVs, since several trips may be required to deliver the necessary materials for fence repair.

Safety of Visitors, Personnel, and Contractors – The use of a UTV would decrease safety concerns that may occur compared to prolonged hours spent in the field with pack animals, or on foot. A UTV would allow repairs to occur in a safe and efficient manner.

Alternative 4 **Repair and replace breaks in the fence using prohibited methods.**

(This would mean using the available park fleet as a method to transport the people and equipment necessary to repair breaks in the fence).

Description:
In this alternative, park vehicle would be used to carry personnel, wire, posts and the equipment needed to repair/replace the fence over several miles of rough terrain to the worksite. To the extent possible, vehicles

would stay on the old road trace to prevent impacts on the vegetation. The vehicle would only make as many trips as necessary to bring equipment.

Effects:
Using a park vehicle would have short-term, moderate effects on the wilderness character. To minimize effects, the fence repair/replacement would occur in the early spring when there are few visitors in the wilderness area. Staff would check backcountry records to make sure people are not camping in the area. Maintaining the boundary fence would prevent the trespass of livestock and ATVs into the wilderness area. However, using a park vehicle for the maintenance of a fence would have some effects on wilderness due to the use of actions that intentionally manipulate or control ecological systems inside of wilderness, and could cause some visual and noise intrusions. Additionally, the presence of a fence itself could prevent the movement of native wildlife and could affect several qualities of wilderness as described below.
Wilderness Character:

"Untrammeled" – The untrammeled nature of the area would be temporarily and adversely affected. Maintaining a fence around the wilderness area could impede the natural movement of native ungulates (e.g., pronghorn) across the landscape. The use of a park vehicle would also affect the untrammeled quality because it is an action that represents modern human control and manipulation in the wilderness.

"Undeveloped" – The undeveloped nature of the area would be affected due to the presence and maintenance of a boundary fence. The presence of structures, such as livestock fencing, degrades the undeveloped quality of wilderness. Additionally, the undeveloped nature would be temporarily adversely affected by the continued use of the old two-track roads within the wilderness area.

"Natural" – The natural quality of wilderness could be affected by the presence and continued maintenance of a fence in wilderness. The maintained fence would degrade the natural quality of wilderness because it could impede natural movement of native ungulates (e.g., pronghorn). The use of a park vehicle could also temporarily and adversely affect the natural quality of wilderness due to noise intrusions and possible soils impacts.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – This quality would be temporarily and adversely affected due to the presence of a park vehicle, which may reduce visitors' perception of solitude due to visual and noise intrusions caused by the presence of a vehicle. However, the access point used for fence repair is rarely used by park visitors.

"Other features and values" – Paleontological and archeological resources would not be affected.

Other Criteria:

Maintaining Traditional Skills – N/A

Special Provisions – N/A

Economic and Time Constraints – This would be the most economically sound and time-efficient option for fence repair.

Safety of Visitors, Personnel, and Contractors – The use of a park vehicle would decrease safety concerns that may occur compared to prolonged hours spent in the field with pack stock, or on foot. A use of a park vehicle would allow repairs to occur in a safe and efficient manner.

Comparison of Alternatives

It may be useful to compare each alternative's benefits and adverse effects to each of the criteria in tabular form, keeping in mind the law's mandate to "preserve wilderness character."

The relative beneficial or adverse effects of the alternative decision criteria are presented in the following table according to whether they would have minor beneficial or adverse effects (+, -), multiple or greater than minor beneficial or adverse effects (++,--), no effect (N/E), or are not applicable (N/A).

	No Action	Alternative 2	Alternative 3	Alternative 4
Untrammeled	--	+ -	-	--
Undeveloped	0	-	-	-
Natural	--	+ -	-	-
Solitude or Primitive Recreation	--	-	-	-
Other Features and Values	-	0	0	0
WILDERNESS CHARACTER	- 7	- 2	- 4	-5

	No Action	Alternative 2	Alternative 3	Alternative 4
Maintaining Traditional Skills	N/A	+	N/A	N/A
Special Provisions	N/A	N/A	N/A	N/A
Economics & Timing	N/A	-	+	+
OTHER CRITERIA SUMMARY	N/A	0	+1	+ 1

	No Action	Alternative 2	Alternative 3	Alternative 4
SAFETY (PUBLIC AND WORKERS)	Neutral	- 1	+ 1	+ 1

Safety Criterion

Occasionally, safety concerns can legitimately dictate choosing one alternative that degrades wilderness character (or other criteria) more than an otherwise preferable alternative. In that case, describe the benefits and adverse effects in terms of risks to the public and workers for each alternative here, but avoid pre-selecting an alternative based on the safety criteria in this section.

Documentation:

To support the evaluation of alternatives, provide an analysis, reference, or documentation and avoid assumptions about risks and the potential for accidents. This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.

The information used to select the preferred alternative was based on the best professional opinions of NPS park staff.

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG *Instructions* before describing the selected alternative and describing the rationale for selection.

Selected alternative: 3

Rationale for selecting this alternative (including safety criterion, if appropriate):

Alternative 3 was determined to best address the criteria for preserving the qualities contributing to Petrified Forest National Park's wilderness character. The alternative would permit a limited use of wilderness-prohibited tools and methods to transport staff, tools, and materials to fence repair sites. Because trespass cattle and vehicle intrusions can cause severe and adverse effects to the untrammeled, natural, and solitude or primitive recreation qualities of wilderness, and other features and values such as paleontological and archeological resources, it was determined that maintaining the boundary fence was more protective of wilderness character than not maintaining the boundary fence. However, the fence and old park road would continue to diminish the undeveloped qualities of wilderness.

The limited use of UTVs would be expected to slightly diminish the untrammeled nature of the wilderness area, with no substantial or lasting evidence of fence repair activities to mar the natural or solitude and primitive recreation qualities of wilderness. Using UTVs instead of the park vehicle fleet would also prevent further maintenance to the old park road, since UTVs should be able to cover more ground and move over rougher terrain than the typical vehicle fleet available. No permanent roads or structures would be built or maintained. Visitor encounters with fence maintenance activities could result in short-term disruptions to their experience of solitude and other recreational wilderness attributes. Such encounters, however, would be infrequent, localized, and of limited duration.

Alternative 3 was determined to increase safety when compared to using traditional pack animals to transport fencing supplies and maintenance tools. The use of stock animals for fence repair would lead to long hours in the field, and would require extensive training to ensure the safety of NPS staff or contractors. Additionally, the park does not currently have pack stock available. Contracting or purchasing stock animals for fence repairs in wilderness would increase costs and time used for training staff.

The National Park Service would continue to foster the skills necessary to maintain the fence in wilderness, and these skills would be imparted to NPS maintanence staff or contractors through appropriate training and educational programs to minimize wilderness impacts. This analysis will be evaluated annually to ensure that actions are still required to maintain fencing, and thus protect wilderness character.

Monitoring and reporting requirements:

All fence maintenance activities would be evaluated to ensure that they are conducted in accordance with the protection of wilderness qualities and values. Monitoring would occur during fence repair to ensure compliance with all applicable laws and policies, and subsequent long-term monitoring would ensure that no lasting evidence of maintenance activities remain to degrade wilderness qualities. Should monitoring reveal evidence of diminished wilderness conditions, appropriate mitigation or adaptive management strategies would be implemented to promote the recovery of wilderness qualities and values.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☒ Mechanical transport
- ☐ Motorized equipment
- ☒ Motor vehicles
- ☐ Motorboats
- ☐ Landing of aircraft
- ☐ Temporary road
- ☒ Structure or installation (Maintain fence)

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

APPENDIX E: CONSULTATION LETTERS

United States Department of the Interior
U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

In reply refer to:
AESO/SE
22410-2011-SL-0484 August 31, 2011

Memorandum

To: Superintendent, National Park Service, Petrified Forest National Park, Petrified Forest, Arizona (Attn: Bradley S. Traver)

From: Field Supervisor

Subject: Wilderness Stewardship Plan for the Petrified Forest National Park, Navajo and Apache Counties, Arizona

Thank you for your recent request for information on threatened or endangered species, or those that are proposed to be listed as such under the Endangered Species Act of 1973, as amended (ESA), which may occur in your project area. The Arizona Ecological Service Field Office has posted lists of the endangered, threatened, proposed, and candidate species occurring in each of Arizona's 15 counties on the Internet. Please refer to the following web page for species information in the county where your project occurs:
http://www.fws.gov/southwest/es/arizona

If you do not have access to the Internet or have difficulty obtaining a list, please contact our office and we will mail or fax you a list as soon as possible.

After opening the web page, find County Species Lists on the main page. Then click on the county of interest. The arrows on the left will guide you through information on species that are listed, proposed, candidates, or have conservation agreements. Here you will find information on the species' status, a physical description, all counties where the species occurs, habitat, elevation, and some general comments. Additional information can be obtained by going back to the main page. On the left side of the screen, click on Document Library, then click on Documents by Species, then click on the name of the species of interest to obtain General Species Information, or other documents that may be available. Click on the "cactus" icon to view the desired document.

Please note that your project area may not necessarily include all or any of the species in a list. The information provided includes general descriptions, habitat requirements, and other information for each species on the list. Under the General Species Information, citations for the Federal Register (FR) are included for each listed and proposed species. The FR is available at most Federal depository libraries. This information should assist you in determining which species may or may not occur within your project area. Site-specific surveys could also be helpful and may be needed to verify the presence or absence of a species or its habitat as required for the evaluation of proposed project-related impacts.

Endangered and threatened species are protected by Federal law and must be considered prior to project development. If the action agency determines that listed species or critical habitat may be adversely affected by a federally funded, permitted, or authorized activity, the action agency will need to request formal consultation with us. If the action agency determines that the planned action may jeopardize a proposed species or destroy or adversely modify proposed critical habitat, the action agency will need to enter into a section 7 conference. The county list may also contain candidate or conservation agreement species. Candidate species are those for which there is sufficient information to support a proposal for listing; conservation agreement species are those for which we have entered into an agreement to protect the species and its habitat. Although candidate and conservation agreement species have no legal protection under the Act, we recommend that they be considered in the planning process in the event that they become listed or proposed for listing prior to project completion.

If any proposed action occurs in or near areas with trees and shrubs growing along watercourses, known as riparian habitat, we recommend the protection of these areas. Riparian areas are critical to biological community diversity and provide linear corridors important to migratory species. In addition, if the project will result in the deposition of dredged or fill materials into waterways, we recommend you contact the Army Corps of Engineers which regulates these activities under Section 404 of the Clean Water Act.

The State of Arizona and some of the Native American Tribes protect some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species, or contact the appropriate Native American Tribe to determine if sensitive species are protected by Tribal governments in your project area. We further recommend that you invite the Arizona Game and Fish Department and any Native American Tribes in or near your project area to participate in your informal or formal Section 7 Consultation process.

Some projects may potentially impact species that are protected under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. sec. 703-712) and/or bald and golden eagles protected under the Bald and Golden Eagle Protection Act (BEGPA). Prohibitions under the MBTA include the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except as specifically authorized by the FWS. If you believe migratory birds will be affected by the project, we recommend you contact our Migratory Bird Permit Office, P.O. Box 709, Albuquerque, NM 87103, (505) 248-7882 or by email *FW2_birdpermits@fws.gov*. For more information regarding the MBTA and permitting process, please visit the following web site: *http://www.fws.gov/migratorybirds/mbpermits.html*. For information on protections for bald eagles under the BGEPA, please refer to the FWS's National Bald Eagle Management Guidelines (72 FR 31156) and regulatory definition of the term "disturb" (72 FR 31132) that were published in the Federal Register on June 5, 2007. Existing take authorizations for bald eagles issued under the ESA became covered under the BEGPA via a final rule published in the Federal Register on May 20, 2008 (73 FR 29075).

For additional communications regarding this project, please refer to ecosultation number 22410-2011-SL-0484. We appreciate your efforts to identify and avoid impacts to listed and sensitive species in your project area. If we may be of further assistance, please feel free to contact Brenda Smith (928) 226-0614 (x101) for projects in Northern Arizona, Debra Bills (602) 242-0210 (x239) for projects in central Arizona and along the Lower Colorado River, and Scott Richardson (520) 670-6150 (x242) for projects in southern Arizona.

for Steven L. Spangle

cc: Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ

cc: Chris Church, Project Manager, National Park Service, Denver, CO

W:\Cathy Gardner\administration\species ltrs\complete\NPS Wilderness Stewardship Plan for the Petrified Forest.docx:cgg

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

[illegible]
[illegible]

June [illegible]

U.S. Fish and Wildlife Service
Arizona Ecological Services Field Office
2321 W. Royal Palm Road, Suite 103
Phoenix, AZ 85021

Subject: Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park

The National Park Service is beginning the process to develop a Wilderness Stewardship Plan for Petrified Forest National Park in Navajo and Apache counties, Arizona. The purpose of this long-term, comprehensive plan is to define the overall management direction for the 50,260 acres of designated wilderness located within the park's boundary.

I am requesting a current list of federally listed plant and animal species (and the location of designated critical habitat, if any, for such species) that might occur within the park's designated wilderness area. I have enclosed a copy of our scoping newsletter that includes a map of our park's designated wilderness area.

This request should record that the National Park Service is initiating consultation with your agency pursuant to the requirements of the Endangered Species Act and National Park Service management policies.

I appreciate your attention to this inquiry and look forward to working with your office throughout this planning effort. If you have any questions please contact Chris Church at [illegible].

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: Chris Church, Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

[illegible]

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

[illegible]

November [illegible], 2013

Mr. [illegible]
[illegible]
Pueblo of the Zuni Fish & Wildlife Dept.
P.O. Box [illegible]
Zuni, NM [illegible]

Subject: Wilderness Stewardship Plan Environmental Assessment for Petrified Forest National Park

Dear Mr. [illegible]:

The National Park Service has initiated the preparation of a Wilderness Stewardship Plan / Environmental Assessment for Petrified Forest National Park. The plan will provide National Park Service [illegible] wilderness [illegible] National Park [illegible]

[illegible] National Historic Preservation Act [illegible] Zuni [illegible] Petrified Forest National Park [illegible]

Please contact me at [illegible] if you have any questions.

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: [illegible], Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

TAKE PRIDE IN AMERICA

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

[illegible]
[illegible]

November [illegible], 2011

Mr. [illegible]
Department of Natural Resources
Pueblo of Zuni [illegible] & Wildlife Dept
P.O. Box [illegible]
Zuni, NM [illegible]

Subject: Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park

Dear Mr. [illegible]

The National Park Service has [illegible] the preparation of a Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park. [illegible] National Park Service [illegible] comprehensive [illegible] the preservation, management, and use of the park's wilderness [illegible] wilderness character. The plan will [illegible] the park [illegible]

[illegible] National Historic Preservation Act [illegible] Zuni [illegible] We will continue to keep you informed [illegible] Petrified Forest National Park [illegible]

Please contact [illegible] at (928) 524-6228 [illegible] questions.

Sincerely,

Bradley S. Traver
Superintendent

File Code

cc: [illegible], Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
[illegible]
1 Park Road
Petrified Forest, Arizona [illegible]

[illegible]
[illegible]

November [illegible]

Dr. [illegible]
[illegible]
P.O. Box [illegible]
[illegible]

Subject: Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park

Dear Dr. [illegible]

The National Park Service has initiated the preparation of a Wilderness Stewardship Plan / Environmental Assessment for Petrified Forest National Park. [illegible]

[illegible]

Please contact [illegible] if you have any questions.

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: [illegible], Project Manager
National Park Service, Denver Service Center
[illegible]
Denver, Colorado [illegible]

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box [illegible]
1 Park Road
Petrified Forest, Arizona [illegible]

[illegible]

November [illegible]

Mr. [illegible]
Navajo Nation
[illegible]
[illegible]
Window Rock, AZ [illegible]

Subject: [illegible] Petrified Forest National Park

Dear Mr. [illegible]:

[illegible] National Park Service [illegible] Petrified Forest National Park. [illegible]

[illegible] National Historic Preservation Act [illegible] Petrified Forest National Park [illegible]

Please [illegible] questions.

Sincerely,

[signature]

[illegible]
Superintendent

Enclosure

cc: [illegible] Project Manager
National Park Service, Denver Service Center
[illegible]
Denver, Colorado [illegible]

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona [illegible]

[illegible]
[illegible]

[illegible]

Mr. [illegible]
President's Office
Navajo Nation
[illegible]
Window Rock, AZ [illegible]

Subject: Wilderness Stewardship Plan Environmental Assessment for Petrified Forest National Park

Dear Mr. [illegible]:

The National Park Service has initiated the preparation of a Wilderness Stewardship Plan / Environmental Assessment for Petrified Forest National Park. [illegible]

[illegible]

Please contact [illegible] if you have any questions.

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: [illegible]
National Park Service, Denver Service Center
[illegible]
Denver, Colorado [illegible]

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box [illegible]
Petrified Forest, AZ 86028
IN REPLY REFER TO: [illegible]

[illegible]
[illegible]

Mr. Tom Dorsey
Chief, Office of Park Planning and Protection
Denver Service Center
National Park Service
Denver, CO 80225

Subject: Mobile Home Removal Environmental Assessment, Petrified Forest National Park

Dear Mr. Dorsey:

The National Park Service has prepared the Environmental Assessment for Mobile Home Removal, Petrified Forest National Park. The plan will provide for the removal of mobile homes and associated structures from the park, restoration of the natural landscape, and interpretation of the area's cultural resources. The proposed action includes the removal of [illegible] mobile homes, associated structures, and utilities. The plan will also provide for the relocation of [illegible] residents to [illegible]. The environmental assessment has been prepared in accordance with the National Environmental Policy Act of 1969 and the Council on Environmental Quality regulations (40 CFR 1500-1508). The assessment evaluates the environmental impacts of the proposed action and alternatives, including the no-action alternative.

The proposed action would result in the removal of [illegible] mobile homes and associated structures from the park. The mobile homes are located in the [illegible] area of the park and are visible from [illegible]. The removal of these structures would restore the natural landscape and improve the park's scenic quality. The relocation of residents would be coordinated with the [illegible] Housing Authority and other local agencies to ensure adequate housing is available for displaced residents.

Please review the enclosed assessment and provide your comments by [illegible]. If you have any questions, please contact [illegible] at (602) [illegible].

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: Chief, Branch of Environmental Quality
Southwest Cultural Resources Center
[illegible] Avenue, Suite [illegible]
Denver, CO [illegible]

TAKE PRIDE IN AMERICA

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box [illegible]
1 Park Road
Petrified Forest, Arizona 86028

L18 [illegible]

[illegible]

Mr. Tony J[illegible]
Navajo Nation Historic Preservation Office
Historic Preservation Department
P.O. Box [illegible]
Window Rock, AZ 86515

Subject: Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park

Dear Mr. [illegible]:

The National Park Service has initiated the preparation of a Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park. [illegible]

[illegible]

[illegible]

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: [illegible], Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado [illegible]

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

L30
N3047

November 15, 2011

Mr. Leigh J. Kuwanwisiwma
Hopi Tribe Cultural Preservation Office
P.O. Box 123
Kykotsmovi, AZ 86039

Subject: Wilderness Stewardship Plan / Environmental Assessment for Petrified Forest National Park

Dear Mr. Kuwanwisiwma:

The National Park Service has initiated the preparation of a Wilderness Stewardship Plan / Environmental Assessment for Petrified Forest National Park. [illegible]

[illegible]

[illegible]

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: [illegible], Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80225

TAKE PRIDE IN AMERICA

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

[illegible]

November 13, 2012

Mr. Leigh Kuwanwisiwma
Hopi Cultural Preservation Office
P.O. Box 123
Kykotsmovi, AZ 86039

Subject: Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park

Dear Mr. Kuwanwisiwma:

[illegible]

[illegible]

[illegible]

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: [illegible]
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80228

TAKE PRIDE IN AMERICA

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box [illegible]
1 Park Road
Petrified Forest, Arizona 86028

[illegible]
[illegible]

[illegible]

Mr. [illegible] Morgan
[illegible]
P.O. Box [illegible]
[illegible]

Subject: Wilderness Stewardship Plan [illegible] Petrified Forest National Park

Dear Mr. Morgan:

[illegible]

[illegible]

[illegible]

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: [illegible], Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

PEFO (H4215)
xNHS

June 22, 2011

James Garrison
State Historic Preservation Officer
Arizona State Parks
1300 W. Washington
Phoenix, Arizona 85007

Subject: Wilderness Stewardship Plan / Environmental Assessment for Petrified Forest National Park

Dear Mr. Garrison:

The National Park Service has initiated the preparation of a Wilderness Stewardship Plan / Environmental Assessment for Petrified Forest National Park. The plan will provide National Park Service managers a comprehensive guide for the preservation, management, and use of the park's wilderness area to ensure it remains unimpaired for future use and enjoyment. The long-term objective of the plan is to restore, protect, and enhance overall wilderness character. The plan will replace the park's outdated backcountry management plan (1974) and will ensure consistency with the park's 1993 general management plan, reviewed in 2004 and amended in 2010. I have enclosed a copy of our scoping newsletter that includes a map of the park's designated wilderness area.

In accordance with provisions of the National Historic Preservation Act, we invite the participation of the Arizona State Historic Preservation Office in the consultation and planning process. We will continue to keep you informed as the planning effort progresses and welcome at any time your comments and advice on the issues regarding protection and preservation of Petrified Forest National Park's archeological resources and other historic properties as part of this wilderness planning effort.

Please contact me at (928) 524-6228 extension 225 if you have any questions.

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: Chris Church, Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

[redacted]

United States Department of Interior

NATIONAL PARK SERVICE
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

[illegible]
N16

June 27, 2011

Arizona Game and Fish Department
WMHB – Project Evaluation Program
5000 W. Carefree Highway
Phoenix, AZ 85086-5000

Subject: Wilderness Stewardship Plan/Environmental Assessment for Petrified Forest National Park

The National Park Service is beginning the process to develop a Wilderness Stewardship Plan (WSP) for Petrified Forest National Park in Navajo and Apache Counties, Arizona. The purpose of this long-term, comprehensive plan is to define the overall management direction for the 50,260 acres of designated wilderness located within the park's boundary.

I am requesting a current list of state-listed or any other special status species that might occur within the park's designated wilderness areas. I have enclosed a copy of our scoping newsletter that includes a map of the park's designated wilderness area.

This letter serves as a record that the National Park Service is initiating consultation with your agency pursuant to the requirements of National Park Service management policies.

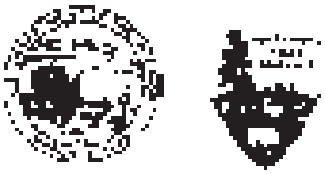
I appreciate your attention to this inquiry and look forward to working with your office throughout this planning effort. If you have any questions please contact Chris Church at (303) 969-2276.

Sincerely,

Bradley S. Traver
Superintendent

Enclosure

cc: Chris Church, WSP Project Manager
National Park Service, Denver Service Center
12795 W. Alameda Parkway
Denver, Colorado 80225-0287



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 sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; 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 by encouraging stewardship and 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.

NPS PEFO EA 110/116477 February 2013

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