OLYMPIC NATIONAL PARK

FIRE MANAGEMENT PLAN

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

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CHAPTER I
Introduction

This Olympic National Park Fire Management Plan is programmatic in nature and establishes specific procedures for implementing National Park Service and Federal wildland fire policy in Olympic National Park.

A. REASONS FOR DEVELOPING THIS PLAN

The Fire Management Plan, based on land management plans and supported by operational plans, is essential for implementation of the 2001 Federal Fire Policy (Interagency Federal Wildland Fire Policy Review Working Group 2001). Fire Management Plans are fundamental strategic documents to guide the full range of fire-management-related activities in an area such as Olympic National Park. The preparation of fire management plans is directed by both National Park Service and Federal wildland fire management policy.

> *"Every park area with burnable vegetation must have a fire management plan approved by the superintendent."* (NPS) Director's Order #18: Wildfire Management Policy.
>
> *"Complete, or update, Fire Management Plans for all areas with burnable vegetation."* 2001 Federal Wildland Fire Management Policy

B. COLLABORATIVE PROCESS

The fire management plan was developed as an interdisciplinary planning effort, with input from park staff, subject matter specialists, neighboring agencies, and the public. All of these parties will continue to be involved during the implementation of the plan. The fire management program integrates protection of human health and safety, ecological processes, wilderness values, threatened and endangered species, air quality, cultural concerns, park developments, and private land owners.

Coordination with neighboring agencies (such as Olympic National Forest, Washington State Department of Natural Resources, local Tribes, and local fire districts) is on-going, and includes joint training interagency communication centers; fire prevention; fire detection; closest forces initial attack, exchange of resources on fires, and collaborative planning. Collaborative efforts aid in the preparation and execution of project level plans, monitoring programs, and hazard fuel reduction programs. The hazard fuel reduction program presents an opportunity to coordinate the efforts of private landowners, state agencies, and federal agencies to create defensible space and fire-safe communities.

Additionally, this fire management plan establishes a "conditional unit" where wildland fires for resource benefit may be managed across agency boundaries once appropriate agreements have been established. This will be a significant step in expanding interagency collaborative efforts.

C. FEDERAL FIRE MANAGEMENT POLICIES

The fire management plan will implement fire management policies and help achieve resource management and fire management goals as defined in: (1) Federal Wildland Fire Management Policy and Program Review; (2) Managing Impacts of Wildfires on Communities and the Environment, and Protecting People and Sustaining Resources in Fire Adapted Ecosystems – A Cohesive Strategy (USDOI/USDA); (3) A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year

Comprehensive Strategy Implementation Plan and (4) NPS Directors Order #18 Wildland Fire Management Policy.

D. REQUIREMENTS OF NEPA AND NHPA

The Olympic National Park Fire Management Plan Environmental Assessment (EA) was prepared to comply with the requirements of the National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA). The fire management plan incorporates a programmatic approach that covers all activities described in the fire management plan. This will reduce the need for NEPA documents for individual projects addressed in the FMP. Additional NEPA (Environmental Assessments (EAs) or Categorical Exclusions (CEs) for specific burns would be required only if external controversial issues arose.

The Fire Management Plan EA was first issued for public comment on September 23, 2002, and was formally submitted to NMFS, USFWS, SHPO for consultation on any actions that could affect threatened and endangered resources or historic resources. Following the public comment period and consultations, the EA was revised and re-issued for public comment in March 2002. Following the public comment period and consultations, the EA was revised as necessary and distributed to the public. This was followed by a 45-day waiting period, at the conclusion which, the National Park Service prepared a Record of Decision. As a summary document, the Olympic National Park Fire Management Plan focuses upon the actions selected for implementation. It is the working document for guiding fire management programs in Olympic National Park.

E. AUTHORITIES

The authorities for implementing this plan are contained in the National Park Service Wildland Fire Management Guideline (Director's Order-18/Reference Manual-18) and Department of the Interior Departmental Manual, Parts 620 and 910. The following statutes authorize and provide the means for managing wildland fire on lands or threatening lands under the jurisdiction of the Department of the Interior, or lands adjacent thereto.

1. Protection Act of September 20, 1922 (42 Stat. 857; 16 U.S.C. 594)
2. McSweeney-McNary Act of 1928 (45 Stat. 221; 16 U.S.C. 487)
3. Economy Act of June 30, 1932 (47 Stat. 417; 31 U.S.C. 1535)
4. Taylor Grazing Act of June 28, 1934 (48 Stat. 1269; 43 U.S.C. 315)
5. O. and C. Act of August 28, 1937 (50 Stat. 875; 43 U.S.C. 1181e)
7. National Park Service Acts as amended (67 Stat. 495; 16 U.S.C. 1 through 4)
8. Federal Property and Administrative Service Act of 1949 (40 U.S.C. 471; et seq.)
9. Reciprocal Fire Protection Act of May 27, 1955 (69 Stat. 66; 42 U.S.C. 1856a)
10. National Wildlife Refuge System Administration Act of 1966 as amended (80 Stat. 927; 16 U.S.C. 668dd through 668ee)
11. Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688; 43 U.S.C. 1601)
12. Disaster Relief Act of May 22, 1974 (88 Stat. 143; 42 U.S.C. 5121)
13. Federal Fire Prevention and Control Act of October 29, 1974 (88 Stat. 1535; 15 U.S.C. 2201)
14. Federal Land Policy and Management Act of 1976 (90 Stat. 2743)
15. Federal Grant and Cooperative Agreement Act of 1977 (P.L. 950224, as amended by P.L. 97-258, September 13, 1982 (96 Stat. 1003; 31 U.S.C. 6301 through 6308)
16. Alaska National Interest Lands Conservation Act of December 2, 1980 (94 Stat. 2371)
17. Supplemental Appropriation Act of September 10, 1982 (96 Stat. 837)
18. Wildfire Suppression Assistance Act of 1989 (P.L. 100-428, as amended by P.L. 101-11, April 7, 1989)

19. Indian Self-Determination and Education Assistance Act (PL 93-638) as amended
20. National Indian Forest Resources Management Act (P. L. 101-630 November 28, 1990)
21. Tribal Self-Governance Act of 1994 (P.L. 103-413)
22. Department of the Interior and Related Agencies Appropriations Act (P.L. 103-32)

CHAPTER II
Relationship to Land Management Planning and Fire Policy

A. NPS MANAGEMENT POLICIES

NPS Management Policies, Section 4.5 – Fire Management, as revised in 2001, states the following:

> "Naturally ignited fire is a process that is part of many of the natural systems that are being sustained in parks. Human-ignited fires often cause the unnatural destruction of park natural resources. Wildland fire may contribute to or hinder the achievement of park management objectives. Therefore, park fire management programs will be designed to meet park resource management objectives while ensuring that firefighter and public safety are not compromised."
>
> "Each park with vegetation capable of burning will prepare a fire management plan and will address the need for adequate funding and staffing to support its fire management program. The plan will be designed to guide a program that responds to the park's natural and cultural resource objectives; provides for safety considerations for park visitors, employees, neighbors, and developed facilities; and addresses potential impacts to public and private property adjacent to the park. An environmental assessment developed in support of the plan will consider the effects on air quality, water, health and safety, and natural and cultural resource management objectives. Preparation of the plan and environmental assessment will include collaboration with adjacent communities, interest groups, state and federal agencies, and tribal governments."
>
> "All fires burning in natural or landscaped vegetation in parks will be classified as either wildland fires or prescribed fires. All wildland fires will be effectively managed through application of the appropriate strategic and tactical management options. These options will be selected after comprehensive consideration of the resource values to be protected, firefighter and public safety, and costs. Prescribed fires are those fires ignited by park managers to achieve resource management and fuel treatment objectives. Prescribed fire activities will include monitoring programs that record fire behavior, smoke behavior, fire decisions, and fire effects to provide information on whether specific objectives are met. All parks will use a systematic decision making process to determine the most appropriate management strategies for all unplanned ignitions, and for any prescribed fires that are no longer meeting resource management objectives."
>
> "Parks lacking an approved fire management plan may not use resource benefits as a primary consideration influencing the selection of a suppression strategy, but they must consider the resource impacts of suppression alternatives in their decisions. Until a plan is approved, parks must immediately suppress all wildland fires, taking into consideration park resources and values to be protected, firefighter and public safety, and costs. Parks will use methods to suppress wildland fires that minimize impacts of the suppression action and the fire, and are commensurate with effective control, firefighter and public safety, and resource values to be protected."
>
> "Suppression activities conducted within wilderness, including the categories of designated, recommended, potential, proposed, and study areas, will be consistent with "minimum requirement" concept identified in Director's Order #41: Wilderness Preservation and Management."

B. ENABLING LEGISLATION AND THE PURPOSE OF THIS NPS UNIT

The park was originally established in 1938, with additions in 1940, 1943, 1953, 1976, 1986, and 1988, bringing the park to 922,653 acres (373,398 hectares). The park was established:

> to preserve for the benefit, use and enjoyment of the people, the finest sample of primeval forests of Sitka spruce, western hemlock, Douglas-fir, and western red cedar in the entire United States; to provide suitable winter range and permanent protection for the herds of native Roosevelt elk and other wildlife indigenous to the area; to conserve and render available to the people, for recreational use, this outstanding mountainous country, containing numerous glaciers and perpetual snow fields, and a portion of the surrounding verdant forests together with a narrow strip along the beautiful Washington coast (H.R. 2247).

In recent years, the park has become internationally recognized as representing unique wilderness ecosystems. In 1967, it was listed as a Biosphere Reserve under the Man and Biosphere Program; and in 1981, the United Nations Educational, Scientific and Cultural Organization (UNESCO) designated the park as a World Heritage site. Approximately ninety-five percent of the park was included in the National Wilderness Preservation System in November 1988.

Olympic National Park is characterized by a rugged topography ranging from sea level to a nearly 8,000 foot (2,438 m) elevation with river systems radiating outward from a central mass of mountains. The park includes two units: a mountainous interior unit and a long, detached coastal strip. In the interior unit vegetation varies from dense lowland forests to subalpine species, and provides habitat for a wide variety of wildlife. Endemic species and threatened and endangered species are found within the park. The 43,404-acre coastal unit consists of heavily forested headlands, bogs and swamps immediately adjacent to sandy beaches, rocky tide pools, offshore sea stacks and islands. Much of the park is without roads, inaccessible except by foot trails, and managed as wilderness. The park's known cultural resources span a time period between 3,000 and 5,000 years, and include both prehistoric and historic sites. It is likely that human occupation of the park extends back at least 10,000 years.

C. DESIRED CONDITIONS

The General Management Plan (GMP)/Environmental Impact Statement, for Olympic National Park is currently being developed, as of the writing of this fire management plan. Until its completion, the park is operating under the Master Plan (NPS, 1976) and the Statement for Management (NPS, 1996).

One of the principle goals of the Master Plan is to "Maintain or restore, where possible, the primary natural resources of the park, and those ecological conditions that would prevail were it not for the advent of modern civilization". The Statement for Management reiterates the importance of protecting resources. It states, "The park's goals are to ensure professional management of natural and cultural resources as integrated systems and to conserve park resources unimpaired for future generations."

The Master Plan identifies the role of fire by stating "The historic role of fire in determining past and present forest conditions is only beginning to be fully recognized. For this reason, naturally occurring fires in remote areas of the park may be allowed to run their course – but only after careful reconnaissance determines that there is no threat to physical developments, private lands and lands outside the park". The Master Plan also calls for protecting the safety and security of all visitors and employees.

D. RESOURCES MANAGEMENT PLAN

The Resources Management Plan for Olympic National Park was updated in 1999**.** It describes the resource management programs needed to accomplish the legislated mandates of the NPS and Olympic National Park, as well as the policies, program emphasis and provisions of related planning documents. The Resources Management Plan includes objectives and project statements related to the restoration and maintenance of natural ecosystems and ecosystem processes, and the maintenance and protection of cultural resources. Although the objectives and project statements do not directly focus on fire management, several indirectly relate to the fire program.

The primary natural resource management objective in the Resources Management Plan states, "Protect the park's natural resource and values in an unimpaired condition. Maintain or restore park "natural zones" to achieve habitat conditions, species diversity and community structure such as would have prevailed through natural events and processes in the absence of European settlement" (Objective 1, RMP Dec. 1999)

While providing for public use and enjoyment, management actions are designed to mitigate impacts to baseline resource quality within the park and disturbances outside the park, which could adversely affect park resources. The highest priority is given to retaining the primeval character and influence of wilderness by preserving natural processes, native species of plants and animals and the diversity of their habitats.

Three other natural resource management objectives apply to fire management:

Objective 2 states; "Protect rare species and restore threatened or endangered species through measures that prevent extirpation, and also minimize adverse influences on other indigenous species." Fire has the ability and is probably one of the most influential actions that can shape the environment that endangered and other indigenous species utilize for habitat.

Objective 3 states: "Encourage, facilitate and participate in scientific research to acquire and analyze information about park resources and effects on these resource, to contribute to resource understanding, public education, and develop the best management strategies for resource management and protection". Continued research will assist Olympic to better understand the role of fire on species and the environment.

Objective 6 states; "Provide for appropriate wilderness uses and outstanding opportunities for solitude, while preserving the park's wilderness resources and wilderness character." Fire has and will continue to play a role in the shaping of the wilderness character of Olympic National Park.

Cultural resource objectives focus on the management of archeological resources, cultural landscapes, ethnographic resources, and historic structures. Fire management is intertwined with cultural management in several ways: through protection of historic structures (fire suppression/hazard fuel reduction), protection of archeological sites (minimum impact tactics), and through research into the possible past use of fire to enlarge and maintain coastal prairies

The park's resource management plan sets forth a goal to preserve the visibility from park viewpoints. Park staff identified important scenic views from park viewpoints in 1980. The scenic viewpoints included Lookout Rock, Hurricane Ridge, Hurricane Hill and Deer Park; all heavily visited areas. Additional vistas may be added as identified by park staff and planning documents. Olympic National Park is designated as a Class I area under the Clean Air Act (CCA), as amended in 1977. Legally, the National Park Service has an affirmative responsibility to protect air quality related values, including visibility, and to allow minimal degradation of these values in Class I areas. Clean Air is important in maintaining the integrity of park resources as well as the visitor experience.

E. MEETING THE OBJECTIVES OF THE MASTER PLAN, STATEMENT FOR MANAGEMENT AND RESOURCE MANAGEMENT PLAN

The Olympic National Park Fire Management Plan implements the fire management-related provisions of the Master Plan and the Statement for Management, and plays a major role in accomplishing the goal of allowing natural processes to prevail. It also outlines the programs needed for protecting visitors, employees and property from risks associated with wildland fire. Additionally, the plan includes mitigation to help protect rare, sensitive, threatened and endangered species; critical habitat, air quality, scenic viewpoints, water quality, wilderness values, and cultural resources.

Vegetative patterns and fire scars show that the lands within the boundaries of the park evolved with the intermittent influence of fire. During most of the twentieth century, however, forest fires were aggressively suppressed. Park managers today recognize that continued exclusion of natural (lightning) fires from the ecosystem would cause undesirable effects, including the loss of diversity in vegetation and wildlife and the degradation of ecosystem health. The fire management program will begin to restore the natural role of fire through the management of naturally ignited wildland fires to accomplish pre-stated resource management objectives in predefined geographic areas. This strategy is termed “wildland fire use” or “wildland fire used for resource benefits”.

The protection of cultural resources (including prehistoric sites, ethnographic resources, cultural landscapes, and historic structures) will be accomplished through hazard fuel reduction and, where appropriate, the use of prescribed fire as a management tool to maintain historic landscapes or to maintain prairies traditionally used by Native Americans. Hazard fuel reduction projects remove excessive live or dead fuel to protect life and property. Prescribed fire is any fire ignited by management actions to meet specific objectives, such as the removal of unwanted encroaching brush and trees.

The fire management plan must also ensure firefighter and public safety as its highest priority, and will do this through the use of hazard fuel reduction and the suppression of those fires that do not meet protection objectives. This plan includes an expanded program of hazard fuel reduction around structures and developed areas.

CHAPTER III
Wildland Fire Management Strategies

A. GENERAL MANAGEMENT CONSIDERATIONS

The Fire Management Plan is a detailed program of action to implement fire management policies and objectives. The program of action for Olympic National Park includes management of wildland fires to benefit the ecosystem; suppression of unwanted fires; reduction of hazard fuel accumulations; application of prescribed fire; fire monitoring; fire research; fire prevention; and operational preparedness. In addition to providing background information, the Fire Management Plan describes the fire management units, fire management strategies, and standard operating procedures.

For most of the past sixty years, the park suppressed all fires – both human-caused and lightning-caused – within its boundaries. The current plan begins the process of restoring the natural role of fire to portions of the park, while maintaining a high priority on protection of human life and property, and neighboring lands. The plan supports the core principles described in the interagency 10-Year Comprehensive Strategy (A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy, 2001): 1) Improve Prevention and Suppression; 2) Reduce Hazardous Fuels; 3) Restore Fire Adapted Ecosystems; and 4) Promote Community Assistance. It has been developed as a collaborative effort, with the assistance of an interdisciplinary staff, neighboring agencies and neighboring private landowners.

B. FIRE MANAGEMENT GOALS FOR OLYMPIC NATIONAL PARK

This section describes how the fire management plan will safely and effectively contribute to achieving the goals in the approved land and resource management plan. These goals provide the programmatic direction for the wildland fire program. Fire program goals reflect Federal fire policy, NPS Director's Orders and the core principals and goals of the10-Year Comprehensive Strategy.

1. Ensure that firefighter and public safety is the first priority in every fire management activity. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy - page 21, Guiding Principle #1; Management Policies 2001 - Sections 4.5 Fire Management, 8.2.5.1 Visitor Safety, 9.1.8 Fire Suppression; Director's Order #18: Wildland Fire Management (NPS, 1998) - Section 5.1 Safety and Health; 10-Year Comprehensive Strategy – Goal #1);

2. Restore and maintain natural fire regimes to the maximum extent practicable so natural ecosystems can operate essentially unimpaired by human interference. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy - page 23, Policy Statement #4; Management Policies 2001 - 4.1 General Management Concepts; Director's Order #18: Wildland Fire Management - Section 4 Operational Policies and Procedures; Olympic National Park Resources Management Plan - Natural Resource Management Objective #1; 10-Year Comprehensive Strategy – Goal #3);

3. Protect Cultural Resources (including prehistoric sites, ethnographic resources cultural landscapes, and historic structures) through hazard fuel reduction and, where appropriate, the use of fire as a management tool in maintaining prairies traditionally used by Native Americans. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy – pages 22-23, Policy statements #3 and #7; Management Policies 2001 - Section 5.3.1.2 Fire Detection, Fire Suppression, and Post-fire Rehabilitation and Protection, and Section 9.1.8 Structural Fire Protection and Fire Suppression; Director's Order #18:

Wildland Fire Management - Section 4.4.c. Operational Policies and Procedures; and Olympic National Park Resources Management Plan - Cultural Resource Objectives 1.5, 2.5, 3.5, and 4.5);

4. Protect Natural Resources (including flora, fauna, air quality, geologic resources, aquatic resources and wilderness character) from adverse influences of wildland fires, fire suppression, prescribed fires, and manual/ mechanical treatments. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy - page 22, Policy statements # 2 and #3; Management Policies 2001 - Section 4.1 General Management Concepts, Section 9.3.9 Wilderness Fire Management, and Section 4.5 Fire Management; Director's Order #18: Wildland Fire Management - Section 3 NPS Management Policies, Section 4.4.c. Operational Policies and Procedures, and Section 5.10 Debris Disposal; and Olympic National Park Resources Management Plan - Natural Resource Management Objectives #1, #2, #6; 10-Year Comprehensive Strategy – Goal #3);

5. Reduce hazardous accumulations of fuels near structures, roadways and wildland-urban interface areas. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy – page 23, Policy statement #7; Management Policies 2001 - Section 9.1.8 Structural Fire Protection and Fire Suppression; and Director's Order #18: Wildland Fire Management - Section 5.9 Fuels Management; 10-Year Comprehensive Strategy Goal #2);

6. Maintain preparedness for fire response. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy – page 24, Policy statement #10; and Director's Order #18: Wildland Fire Management - Section 5.5 Preparedness; 10-Year Comprehensive Strategy – Goal #1);

7. Maximize the efficiency of the fire management program by coordinating with other park divisions and neighboring agencies. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy – page 24, Policy statement #14; Management Policies 2001 - Section 2.3.1.9 Cooperative Planning, and Section 4.1.4 Partnerships; and Director's Order #18: Wildland Fire Management - Section 4.4 Operational Policies and Procedures);

8. Evaluate the costs and benefits of alternative fire management strategies to ensure that financial costs are commensurate with protection or enhancement of resource and wilderness values. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy – page 22, Guiding principle #5, and page 24, Policy statements #10 and #11; and Management Policies 2001 - Section 4.5 Fire Management; 10-Year Comprehensive Strategy – Goal #1);

9. Employ adaptive management strategies. Scientifically manage wildland fire using the best available technology. Use information gained through inventory and monitoring to evaluate and improve the program. (Basis: Review and Update of the 1995 Federal Wildland Fire Management Policy - page 21 Guiding Principle #6; Management Policies 2001 – Section 2.3.1.5 Science and Scholarship; and Director's Order #18: Wildland Fire Management – Section 4.4.g; 10-Year Comprehensive Strategy – Goal #3).

The goal of providing for firefighter and public safety is given the highest priority in evaluating alternative actions. The other goals, equal with one another, are given the next level of priority. It is recognized that achieving every goal to its fullest extent is not possible due to inherent conflicts between the goals. That is to say, that one goal cannot be completely emphasized to the exclusion of other goals.

C. RANGE OF WILDLAND FIRE OPTIONS (STRATEGIES)

This section displays the scope of wildland fire management strategies and program elements that will be implemented within the park unit and developed in the Fire Management Plan.

C.1. WILDLAND FIRE SUPPRESSION

Wildland fire suppression is an appropriate management response to wildland fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire. All wildland fire suppression activities provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and/or the use of critical firefighting resources (NPS, et al., 1998).

A variety of fire suppression techniques are used to break the continuity of forest fuels, cool a fire, and slow the advance of a flaming front. Actions may include construction of fire lines; cutting of vegetation; application of water, foam or retardant; and the application of fire. Most fires in the park are small (less than 1 acre/0.4 hectares) and can be suppressed using hand tools - sometimes supported with a chainsaw for cutting fuels, a fire engine or portable pump for delivering water, and/or a helicopter to transport water, supplies, and firefighters. Larger fires or fires with greater spread potential may require the use of drip torches, fusees, fire line explosives, or retardant aircraft.

In Olympic National Park, all unplanned ignitions will be suppressed utilizing the appropriate management response in the Exclusion Unit, to provide the maximum level of fire protection to developed areas and neighboring lands. Within the Wildland Fire Use and Conditional Units, all fires will be suppressed that do not meet the requirements for wildland fires used to benefit the ecosystem. Fire suppression acreage generally ranges from 0 to 50 acres per year, but in a peak year could be as high as 1,150 acres.

C.2 PRESCRIBED FIRE AND DEBRIS BURNING

Prescribed Fire is any fire ignited by management actions to meet specific objectives. The fuels to be burned may be in either their natural or modified state. The prescribed burn takes place under specified environmental conditions (e.g. weather and fuel moisture); is confined to a predetermined area; is within a range of fire intensity and rate of spread that permits attainment of planned management objectives; and is conducted in conformance with an approved prescribed fire plan that meets NEPA and NHPA requirements prior to ignition.

The “prescription” for a prescribed fire contains key weather and fire behavior parameters necessary to achieve desired fire behavior and results. Pile burns and broadcast burns are two methods of using prescribed fire. Pile burning is used to dispose of vegetative material that has been concentrated by manual or mechanical methods. Piles are located in a wildland fuels environment where fire may spread beyond the pile perimeter. Broadcast burns are prescribed fires applied to wildland fuels scattered over an area. An approved prescribed fire plan is required for all prescribed fires prior to ignition.

Debris disposal is burning of wildland fuels generated from maintenance activities (such as grass or brush mowing or clippings), hazard tree removal, or during construction activities. These materials must be deemed infeasible or impractical to mechanically remove and must be in a non-wildland fuel environment (parking lot, boneyard, gravel pit, etc.) Any material being burned for debris disposal must be classified as permissible to burn under applicable Federal, State and local regulations.

Prescribed fire will be used to remove burn piles generated by the hazard fuel reduction program, and to achieve resource management objectives including research burns and burns to maintain cultural scenes or practices through broadcast burning. (Reference is made to the potential use of prescribed fire in

coastal prairies so that the tool is not precluded when plans are developed for management of these areas.) The hazard fuel reduction program aids in the protection of historic and modern structures. It supports local, regional and national efforts to treat hazard fuels.

Prescribed fire pile burning will occur on up to 200 acres per year as part of the hazard fuel reduction program as described below under non-fire applications. In addition, a maximum of 125 acres will be treated over the next five years using broadcast prescribed burns, with no more than 65 acres treated in any one year.

C.3. WILDLAND FIRE USE

Wildland fire use is the management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas (NPS, et al., 1998).

Wildland fires will receive management actions appropriate to conditions of the fire, fuels, weather, and topography to accomplish specific objectives for the individual fire. These management actions, termed the appropriate management response, may vary from fire to fire and even along the perimeter of an individual fire. Management options range from monitoring with minimal on-the-ground actions to intense fire suppression actions on all or portions of the fire perimeter. The appropriate management response is developed from analysis of the local situation, values-to-be-protected, management objectives, external concerns, and land use.

Lightning-caused fires in the Conditional and Wildland Fire Use Units that meet decision criteria will be managed as wildland fire use actions for the benefit of the ecosystem. This supports the primary natural resource management objective, protecting the park's natural resource and values in an unimpaired condition. Wildland fire use will generally range from 0 to 200 acres in a year, with a maximum of 1,300 acres in a peak year. Typically, the park experiences a combination of lightning ignitions and dry weather only one or two years out of ten.

C.4. NON-FIRE APPLICATIONS: MANUAL/MECHANICAL TREATMENT

Manual treatment is the use of hand-operated power tools and handtools to cut, clear or prune herbaceous and woody species. It is a method of reducing hazardous accumulations of wildland fuels, and is often used to create defensible space near structures. The risk to individual structures will be rated using guidelines adapted from NFPA 299 Standard for Protection of Life and Property from Wildfire (1997). In the park, manual treatment would be used to remove excess woody debris from the ground; to remove "ladder" fuels, such as low limbs and brush (which could carry fire from the forest floor into the crowns of trees); and to thin dense stands of trees around structures in order to reduce the horizontal continuity of fuels. Occasionally, larger mechanized equipment (a boom truck and front end loader) would be used to move large boles, with the restriction that the equipment would not be driven off road. Material cut or gathered through manual/ mechanical treatment would usually be disposed of by piling and burning on site, or burning at an established burn pit. Other methods of disposal, used less frequently due to the size, quantity and location of woody materials, would include chipping and broadcast burning.

Up to 200 acres per year will be treated on a cyclic basis in an effort to eventually maintain lower fuel loads on about 1,000 acres. For the purposes of impact analysis, these acreage figures include work that the park will perform on its own lands and work that private land owners within park boundaries may choose to perform on their own properties. Removal of hazard fuels on private land is at the discretion of the landowner. (The landowner would still be responsible for meeting the requirements of scenic easements, Washington State Forest Practices Act, etc.) Recent legislation (the Wyden Amendment) and

future funding may allow the park to enter into an agreement with the private landowner to assist with treatment on private property in those cases where it is to the benefit of both parties.

Thinned fuels will be piled and burned in place, chipped on site, removed to another location (such as a burn pit), or broadcast burned. The hazard fuel reduction program aids in the protection of historic and modern structures. It supports local, regional and national efforts to treat hazard fuels around structures.

D. DESCRIPTION OF FIRE MANAGEMENT UNITS

D.1. FIRE MANAGEMENT UNITS: OVERVIEW

A Fire Management Unit (FMU) is any land management area definable by objectives, topographic features, access, values-to-be-protected, political boundaries, fuel types, or major fire regime groups, etc. that sets it apart from management characteristics of an adjacent unit. Three fire management units have been defined for Olympic National Park based on goals related to protection of life and property, and restoration of natural fire processes. The three units are the Exclusion Unit, the Conditional Unit and the Wildland Fire Use Unit. The delineation of the units takes into account the values to be protected, local fire history, potential fire behavior, and the presence of natural or man-made barriers to fire spread. Accessibility, smoke dispersal, location of administrative facilities and private property were additional considerations. See Appendix A: Map 3.

The Exclusion Unit, totaling about 320,845 acres (129,846 ha), includes a coastal exclusion unit and an inland exclusion unit. Federal and NPS policy require that human safety be given the highest priority in any fire management program. The exclusion units provide a buffer area where fires are suppressed, thus reducing the chance that an uncontrolled wildland fire would compromise human safety and neighboring lands. The boundaries of the exclusion units were chosen to capitalize on natural containment features such as ridgetops and valley bottoms (where there is less slope); and to provide a relatively safe distance between the wildland fire use unit and developed areas or neighboring properties. ONP is committed to beginning the process of restoring the ecological role of fire in the wildland fire use unit, but must commence the process in a conservative manner since the Park has been operating under full fire suppression management since 1988, and prior to 1985. (From 1985 to 1998 the fire management program included prescribed natural fire.) In the interest of restoring at least a portion of the natural role of fire, the proposed action offers a conservative start with careful consideration of human health and safety, ecological processes, wilderness values, threatened and endangered species, air quality, cultural concerns and neighboring land owners.

The coastal exclusion unit (43,404 acres/17,566 ha) consists of the park's coastal strip. This long, narrow unit is situated between the Pacific Ocean to the west, private and state-owned lands to the east and tribal lands to the North and South. Because the unit is too narrow to permit lightning-caused fires to run their natural course without threatening neighboring lands, all fires in this unit are suppressed.

The inland exclusion unit (277,441 acres/122,280 ha) consists of an irregularly shaped crescent that encircles most of the Wildland Fire Use Unit, except where there is adjoining Olympic National Forest wilderness along the southeast portion of the park. Boundaries of the exclusion unit were chosen to capitalize on natural barriers, where fires could be more readily suppressed. Varying in width from less than one mile to more than ten miles, the inland exclusion unit provides a protective area between the Wildland Fire Use Unit and non-NPS lands. All fires in this unit are suppressed to protect front-country developments and to reduce the risk of wildland fires escaping onto neighboring lands.

The Conditional Unit, totaling about 70,041 acres (28,346 ha), is located along the southeast portion of the park between the park's Wildland Fire Use Unit and Olympic National Forest (USFS) lands. Most of this unit adjoins USFS wilderness. In the Conditional Unit, human-caused fires are suppressed (with possible exceptions noted below under Wildland Fire Use). Lightning-caused fires that meet standard evaluation criteria are managed for the benefit of the ecosystem, unless potential exists for the fires to cross out of the park onto USFS lands. Fires that do not meet the criteria, or that threaten to cross from the park onto the forest are suppressed. If in the future, the park and Olympic National Forest establish agreements allowing joint management of lightning-caused fires, these fires could be permitted to cross agency boundaries. Olympic National Forest is not able to enter into this type of agreement until it has completed its Forest Plan. Once the Forest Plan for Olympic National Forest is complete, it is the intent of ONP to continue with negotiations to allow joint management of wildland fire use fires across common boundaries.

The Wildland Fire Use Unit, totaling about 522,527 acres (211,467 ha), consists of the rugged and remote interior of the park. In this unit, human-caused fires are suppressed (with possible exceptions noted below under Wildland Fire Use). Lightning-caused fires in this unit that meet evaluation criteria are managed for the benefit of the ecosystem. Those fires that do meet the criteria are suppressed.

Table 3.1: Fire Management Units: Elevation Range and Acreage

Elevation	Exclusion Unit	Conditional Unit	Wildland Fire Use Unit
0 – 2000 feet (0 – 610 m)	173,973 acres (70,406 ha)	7,781 acres (3,149 ha)	70,250 acres (28,430 ha)
2,000 – 4,000 feet (610 – 1,220 m)	118,313 acres (47,881 ha)	29,315 acres (11,864 ha)	232,025 acres (93,899 ha)
4,000 – 6,000 feet (1,220 – 1,830 m)	27,669 acres (11,198 ha)	28,497 acres (11,533 ha)	201,997 acres (81,747 ha)
6,000 feet (> 1,830 m)	886 acres (359 ha)	4,473 acres (1,810 ha)	18,268 acres (7,393 ha)
Minimum Elevation	0 feet (0 m)	734.6 feet (223.9 m)	392.1 feet (119.5 m)
Maximum Elevation	7,197.5 feet (2,193.7 m)	7,676.9 feet (2,339.8 m)	7,886.5 feet (2,403.7 m)
Mean Elevation	3,140.2 feet (957.1 m)	3,944.4 feet (1,202.2 m)	3,863.7 feet (1,177.6 m)
Standard Deviation	1,828 feet (557 m)	1,978 feet (548 m)	2,008 feet (612 m)

Table 3.2: Fire Management Units: Slope Range and Acreage

Slope	Exclusion Unit	Conditional Unit	Wildland Fire Use Unit
0 – 35 Degrees	271,271 acres (109,782 ha)	47,960 acres (19,409 ha)	383,898 acres (155,361 ha)
> 35 Degrees	49,570 acres (20,061 ha)	22,105 acres (8,946 ha)	138,644 acres (56,108 ha)
Minimum Slope	0 Degrees	0 Degrees	0 Degrees
Maximum Slope	63.0 Degrees	72.0 Degrees	68.0 Degrees
Mean Slope	31.5 Degrees	36.0 Degrees	34.0 Degrees

Standard Deviation	18.6 Degrees	21.2 Degrees	20.1 Degrees

D.2. VEGETATION AND FIRE REGIME INFORMATION APPLICABLE TO ALL FMUs

a. VEGETATION

In the Olympics, vegetation patterns and fire regimes reflect environmental gradients of moisture and temperature. Moisture increases from east to west and from lower to higher elevations. Temperature decreases from lower to higher elevations. Slope aspects affect these variables as well. Because of similarities in fire regimes and the mosaic of vegetation types found at any elevation, the 17 tree types and 20 shrub/heather types will be lumped into six vegetation zones for this analysis, and are based on potential climax dominants (Henderson et al., 1989; Agee, 1993). Table 3.3 depicts vegetation zones with their corresponding vegetation types and average elevations, while Table 3.4 illustrates the vegetation zones and how they are delineated throughout the fire management units.

Table 3.3. Vegetation Zones, Corresponding Dominant Tree Species, and Typical Elevation in Olympic National Park

Vegetation Zone	Dominant Tree Species	Elevation
Sitka Spruce Zone	Sitka Spruce	Typically below 600 feet.
	Western Hemlock	
	Western Redcedar	
	Red alder	
	Bigleaf maple	
Western Hemlock Zone	Western Hemlock	Elevations extend from about 500 to 2,000 feet on the west side of ONP and from sea level to 4,000 feet on the east side.
	Douglas-fir	
	Western Redcedar	
Douglas-fir Zone	Douglas-fir	Middle elevations in the upper Dungeness River drainage.
	Lodgepole pine	
	Madrone	
Silver Fir Zone	Pacific silver fir	Throughout the interior of the park, generally at middle elevations.
	Western hemlock	
	Douglas-fir	
	Alaska yellow-cedar	
Mountain Hemlock Zone	Pacific silver fir	Generally above 3,500 feet (1,067 meters)
	Western hemlock	
	Mountain hemlock	
	Alaska yellow-cedar	
Subalpine Fir Zone	Subalpine fir	Generally above 4,000 feet (1,219 meters)
	Douglas-fir	
	Lodgepole pine	

Sitka Spruce Zone This zone occurs on the wettest sites in the most humid regions of the park. The Hoh, Queets, Quinault, and Bogachiel rainforest valleys are included in this zone. Common shrubs include salmonberry (Rubus spectabilis), salal (Gaultheria shallon), vine maple (Acer circinatum), red huckleberry (Vaccinium parviflorium) and Alaska huckleberry (Vaccinium alaskaense). Fires in the Sitka Spruce Zone are rare due to heavy precipitation, frequent fog and high fuel moisture. There have been very few fires of appreciable size in the last 700 years. The scarcity of fire allows shallow-rooted, thin-barked tree species such as spruce, western hemlock and western redcedar to predominate.

Western Hemlock Zone This is the most widespread zone in the park. Located inland and at higher elevations than the Sitka Spruce Zone, climatic extremes are somewhat greater here. Western hemlock is the climax dominant, however, much of the area is populated by sub-climax Douglas-fir resulting from past fires or other disturbance. Common shrubs include salal, vine maple, Oregongrape (Berberis nervosa), red huckleberry, Alaska huckleberry, salmonberry and rhododendron (Rhododendrom macrophyllum). Fires occur more frequently in the Western Hemlock Zone than the Sitka Spruce Zone, and this favors the establishment and perpetuation of Douglas-fir, a fire-adapted species. Fire is the primary large-scale disturbance factor in this zone. On drier sites, fires have burned frequently in the past, while on moister sites fires have burned rarely in the last 500 years.

Douglas-fir Zone This zone occupies the driest sites in the northeastern Olympics. Common shrubs include kinnikinnik (Arctostaphylos uva-ursi), Oregongrape, serviceberry (Amelanchier alnifolia), oceanspray (Holodiscus discolor), baldhip rose (Rosa gymnocarpa), creeping snowberry (Symphoricarpus mollis) and salal. Stands in this dry zone have burned frequently in the past, and fire return intervals are among the shortest in the park.

Silver Fir Zone This zone is located above the Western hemlock zone and below the Mountain hemlock zone. Common shrubs include Alaska huckleberry, red huckleberry, salmonberry, fool's huckleberry (Menziesia ferruginea), salal, and Oregongrape. The relatively cool, moist conditions of the Silver Fir Zone are less conducive to fire. Because of this, fires burning in the Western Hemlock Zone tend to go out when they reach the edges of the Silver Fir Zone except under extreme weather conditions (drought plus east wind). The infrequent fires that do occur are of high intensity. (Agee, 1993) Fires have burned rarely in this zone in the past 500 to 1,000 years, except in Silver Fir/Rhododendron (Abies amabilis/Rhododendron macrophyllum) and Silver fir/Rhododendron-Alaska Huckleberry (Abies amabilis/Rhododendron macrophyllum-Vaccinium alaskaense) plant associations, where frequent fires have occurred over the last 500 years (Henderson et al., 1989).

Mountain Hemlock Zone Traditionally found at upper elevations and particularly on wetter sites, the mountain hemlock zone is known to grade into subalpine parkland in the upper portions of the zone. Winter snowpacks usually exceed 10 feet (3 m) in this zone. Common shrubs include Alaska huckleberry, oval-leaf huckleberry (Vaccinium ovalifolium), big huckleberry, white rhododendron (Rhododendron albiflorum), mountain ash (Sorbus sitchensis), fool's huckleberrry, and red heather (Phyllodoce empetriformis). Many fires in this zone are limited by discontinuous fuels and high fuel moistures; however, when conditions are favorable, fires in this zone are characterized by erratic and unpredictable behavior and high severity.

Subalpine Fir Zone This zone occurs at upper elevations also, but only in the drier parts of the Olympics such as the upper part of the Dungeness. Snow accumulations are usually less than 10 feet (3 m). Vegetation patterns are characterized by tree clumps interspersed with parkland and meadows. The fire return interval, averaging 208 years, is among the shortest on the Olympic peninsula. Fire behavior and fire effects are similar to the Mountain Hemlock Zone. Fire is the primary large-scale disturbance in this zone, and tends to promote Douglas-fir and lodgepole pine in addition to subalpine fir. The harsh environment at upper elevations and the distance from seed sources can retard the re-establishment of trees in the Mountain Hemlock and Subalpine Fir Zones. Meadows created by fire can persist for more than a century (Agee, 1993).

Subalpine Meadows Subalpine heather/huckleberry meadows usually act as a barrier to the spread of fire, but under severe conditions may carry fire Resprouting of heather (Potash, 1989) or huckleberry may occur following fire. Meadows created by fire can persist for more than a century. Climate shifts to colder, wetter growing seasons favor tree establishment in burned subalpine meadows, while climate

shifts to warmer, dryer growing seasons favor tree establishment in heather meadows (Agee and Smith, 1984).

Table 3.4: Vegetation Zones and FMUs
Acreage and Percent of Vegetation Type in Each Fire Management Unit

	Exclusion Unit (Acres)	(% of Total Exclusion Unit acreage)	Condition-al Unit (Acres)	(% of Total Condition al Unit acreage)	Wildland Fire Use Unit (Acres)	(% of Total Wildland Fire Use Unit acreage)
Sitka Spruce Zone	67,366	21.0%	0	0%	4,418	0.8%
Western Hemlock Zone	129,541	40.4%	14,059	20.1%	70,651	13.5%
Silver Fir Zone	71,087	22.2%	17,207	24.6%	108,202	20.7%
Mountain Hemlock Zone	25,757	8.0%	16,716	23.9%	156,289	29.9%
Subalpine Fir Zone	16,786	5.2%	6,026	8.6%	26,312	5.0%
Douglas Fir Zone	0	0%	761	1.1%	0	0%
Non-Forest Acreage	10,054	3.1%	15,242	21.8%	156,443	30.0%
Total (Vegetation Zones per FMU)	320,590		70,012		522,316	

Rare or Sensitive Species

There are 9 endemic plant species and more than 50 rare or sensitive (state-listed) plant species within ONP. (See Wildland Fire Management Plan Environmental Assessment, Appendix F-2 Special Category Vascular Plants.) At this time, there are no known federally listed special status vascular plants within Olympic National Park, however there are four USFWS species of concern, one of which is thought to be extirpated. The list of rare or sensitive plant species will be reviewed and revised as necessary on an annual basis to ensure current information for each fire season.

Non-Native, Invasive Species

Approximately 313 species of non-native plants are found within Olympic National Park, representing approximately 20 percent of the known park flora (by number of species). Some of the most commonly found non-native plants include Scot's broom (Cytisus scoparius), English holly (Ilex aquifolium), English ivy (Hedera helix), Reed canarygrass (Phalaris arundinacea), Canada thistle (cirsium arvense),

and Herb Robert (Geranium robertianum). Most park non-native plants (55 percent) are perennials, which are the most persistent and difficult plants to control or eradicate. Attempts to limit species invasion by hand pulling, use of select herbicides and other techniques on known areas has had limited success. While the majority of non-native plants are found in disturbed front-country sites, non-native plants occur through all geographic areas of the park and in all elevation zones.

Fire alone may not be an effective control technique for noxious perennial exotic plants in ONP. In most cases, burning would result in an increase in plant density. ONP has not used burning as a control technique, but has used debris burning to dispose of piles of Cytisus scoparius, Ilex aquifolium, etc., that were controlled by pulling or cutting. ONP has experimented with "flaming" on a limited basis. Flaming is a technique that involves using a propane torch, which is passed quickly over the foliage of certain evergreen perennials such as Hypericum calycinum or Hedera helix. The heat singes the foliage. The plant responds to the flaming by using energy to repair the damage. Repeated flaming may suppress or partially control some species. Since it is as labor-intensive as spraying and repeated treatments are usually necessary, flaming probably has limited application at Olympic. In the Andrews Field area of the Queets, prescribed fire is being considered as a site prep and precursor to other treatments. Further non-fire treatments will be identified in other planning documents. Reference is made to the potential use of prescribed fire in the fire management plan so that the tool is not precluded when plans are developed for management of exotics.

b. FIRE REGIMES

Vegetation Zones and Fire Regimes

Vegetation studies by Henderson, et al. (1989) on the neighboring lands of Olympic National Forest, revealed that plant associations and vegetation zones correlate with patterns of past fire activity. They state, “In the cooler moister associations, fires appear to have been much less frequent than on drier or warmer types. An analysis of the reconstructed fire patterns showed that the Sitka Spruce, Silver Fir and Mountain Hemlock Zones had much less acres burned than the Western Hemlock, Subalpine Fir or Douglas-fire Zones…The fire return period for the Sitka Spruce, Mountain Hemlock and Silver Fir Zones for the last 800 years were 900, 844 and 629 years respectively for the Western Hemlock, Subalpine Fir and Douglas-fir Zones they were 234, 208 and 138 years respectively…" There has not been a peer reviewed, comprehensive, quantitative, analysis of forest disturbance history for ONP. However, disturbance maps for the peninsula presented by Henderson et al., 1989; and Agee, 1994, which are based on studies of neighboring lands and limited field studies in the park, indicate that there is a gradient of fire regimes across the park. Wind is the primary disturbance factor on the west side of the park, (with fire return intervals greater than 500 years), while fires are the primary disturbance factor on the east side of the park and along the north edge (with fire return intervals below 200 years in places).

Intensity and Severity

The fire regimes on the Olympic Peninsula are characterized by infrequent fires ranging from low to high intensity. Most fires that burn any significant acreage are high severity fires that kill the majority of trees on the burned sites and are called “stand replacement fires”. These severe fires consume a great deal of fuel, but create even heavier fuel loads following the fires in the form of scorched needles, dead trees and fine herbaceous fuels (Agee and Huff, 1987). Fuel loadings are typically heavier at lower elevations, where fuels would often be characterized by National Fire Danger Rating System (NFDRS) fuel model G: dense conifer stands with a heavy accumulation of litter and down woody material. Fuel loadings in the subalpine areas are usually lower overall, though there are often “jackpots” of fuel, that would be characterized by NFDRS fuel model H: short needle conifer. Weather and fuel moisture are often the driving factors in fire behavior. Large fires may burn for weeks but make their major runs during a few

days of east wind weather when the temperature is high and the relative humidity is low. In the eastern Olympics, an occasional fire of lower intensity will burn through the understory without killing the overstory (Wetzel and Fonda, 2000).

Conditions for Large Fires

Forest fires usually occur during the dry summer months of July, August and early September. Large fires typically occur on steep south-facing slopes, and require a combination of circumstances including a source of ignition (such as lightning), an extended period of drought, and east winds (Huff and Agee, 1980). Hot, dry east winds (subsidence winds) occur more frequently in the late summer and early fall than in the early summer. Under average summer conditions, most fires go out on their own at less than one-quarter acre (0.1 ha) due to high fuel moisture and topographic barriers (Pickford et al., 1977). In the Olympics, large fires are typically characterized by three distinct movement patterns. In the western portion of ONP, fires tend to move upslope-downslope rather than upvalley-downvalley, while in the eastern Olympics fires move simultaneously upslope and upvalley. Fires in the Soleduck River-Lake Crescent area are funneled in an east to west direction by the terrain (Agee, 1983).

Distribution and Frequency

Fire occurrence in the Olympics is irregular and episodic rather than cyclic (Agee, 1993). Agee (1994) observes that the episodic nature of fire on the Olympic Peninsula "implies that prediction of future events based on past history is difficult". Although lightning occurs every year, some years there are no detected lightning fires. There were no lightning fires detected during 30 of the past 64 years, and during 7 of the past 25 years. Lightning fires occur more frequently on the north and east sides of the peninsula than on the west-side. Lightning storms usually track from south to north, often with a concentration along the western ridges of the Elwha.

Under the classification system described by Schmidt, et al. (2002), and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003), the fire regimes in the park would be characterized as Class IV and V, with fire return intervals generally ranging from 35 to more than 100 years. On the wet west side of the park the average fire return interval exceeds 500 years (and in places may be more than 1,000 years), while on the drier east side and along the north edge it is on the order of about 200 years (Agee, 1994). One study in the Morse Creek drainage calculated a fire return interval as short as 24 years (Wezell and Fonda, 2000) (It should be noted, however, that the assumptions and methodology of this study differed from earlier studies.)

Prehistoric Fires

Layers of charcoal in soil and bogs, fire-scarred remnant trees and wide-spread stands of Douglas-fir give evidence of major fires that burned on the Olympic Peninsula in past centuries. Fire activity was probably linked to large-scale climatic fluctuations. Major fires burned during three time periods within the Little Ice Age: around 1308, 1448 to 1538, and 1668 to 1701. The most recent of these fires burned more than a million acres (404,700 ha) on the north and east sides of the peninsula, and resulted in extensive stands dominated by Douglas-fir (Henderson et al., 1989). Agee (1983) notes that on the west side of the park there appears to be remnants of a 750-year old age class of trees followed by a 500-year old age class. Near the coast, Native Americans may have maintained or enlarged Roose's and Ahlstrom's Prairies through the use of fire.

Historic Fires

Miller (1943) lists numerous large fires that occurred on the Olympic Peninsula between 1865 and 1942, many ignited by land clearing or logging activities as well as by lightning. More than forty-five of these fires were larger than 1,000 acres (405 ha). Near the park, the Dungeness Fire of 1890/91 burned about 30,000 acres (12,141 ha) while the Soleduck Burn of 1907 covered approximately 12,800 acres (5,180 ha). In 1951, the Forks Fire burned 33,000 acres (13,355 ha) up to the edge of town. In contrast, in the past 50 years there have been only two fires in the park that exceeded 1,000 acres, with a similar lack of activity outside the park. The decrease in large fire activity may be explained in part by changes in land use patterns and improved fire detection/ suppression techniques, however, the peninsula has also experienced wetter summers in recent decades (Henderson et al., 1989).

Suppression Policies

Major fires in the western states in the early 1900's led to fire policies of aggressive suppression. Difficult access and limited suppression resources hampered early suppression efforts. In later decades, however, improvements in detection, firefighting technology, and fire organizations increased the effectiveness of fire suppression actions, especially in extinguishing small fires (fires less than 1 acre/0.4 ha in size). When Olympic National Park was established in 1938, the National Park Service continued the policy of fire suppression. In the mid-1980's, a growing appreciation for the importance of fire as a natural disturbance factor led the park to develop a plan to manage some natural fires for the benefit of the ecosystem, rather than suppressing them. The 177 acre Kimta Peak fire (1987) was the only large prescribed natural fire managed in Olympic National Park during this period. Major fires in Yellowstone in 1988 caused the National Park Service to revise its fire management guidelines and all parks were required to suppress all fires until their fire management plans were updated accordingly. ONP was in a suppression mode from that time until the current plan was put in place.

Agee and Flewelling (1983) observed that "the effect of fire suppression has been to catch fires when they are small and before east winds develop." Because fire return intervals in the park are so long, the years of fire suppression have probably had minimal impact park-wide to date. The vegetative composition, structure and fuels across the park are considered to be in a Condition Class I, with little departure from the historical or natural range of variability. However, some of the natural fires that were suppressed at a small size might otherwise have grown large, creating forest openings and diverse habitats. It may be hundreds of years before fires occur again at those sites. In the meantime, the diversity of habitat is reduced in these localities. If suppression were continued park-wide indefinitely, it would eventually affect stand structure and composition, the abundance of subalpine meadows (Agee, 1993), and habitat available for wildlife species (Huff, 1984). Under the system described by Schmidt et al. (2002) and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003), most areas of the park would presently be characterized as Condition Class 1- the vegetation composition, structure, and fuels similar to those of the historic fire regime and do not pre-dispose the system to risk of key ecosystem components.

Table 3.5: Fire History: East-Side versus West-Side

1938 – 2001	**East of Elwha**	**West of Elwha**	**Total**
Number of Fires	661 fires	464 fires	1,125 fires
Burned Area	3,683 acres (1,491 ha)	1,725 acres (698 ha)	5,408 acres (2,189 ha)

Table 3.6: Fire History of Fire Management Units*

1938 - 2001	**Exclusion Unit**	**Conditional Unit**	**Wildland Fire Use Unit**
Number of Fires	640	105	380
Burned Area	735 acres (297 ha)	1,548 acres (626 ha)	3,124 acres (1,264 ha)

*These are the burned areas experienced from 1938 to 2001, a period of full fire suppression, except for three years in the mid-1980's. The only fire of any size to be managed as a "Prescribed Natural Fire" was the 177 acre (72 ha) Kimta Fire in 1987, located in the Wildland Fire Use Unit.

Lightning vs. Human-Caused Fires

Since the park's establishment in 1938, forest fires have burned approximately 5,408 of the 922,653 acres (2,189 of the 373,398 ha) that comprise the park. Sixty percent of all fires have been human-caused, but 67 percent of the total acreage burned was the result of lightning fires. Eighty-seven percent of all fires were less than 1 acre (0.4 ha).

Fire Acreage in the Past 25 Years

The maximum fire suppression acres projected for the alternatives in the Environmental Assessment were estimated from the actual acres that were suppressed or managed in the 25-year period between 1977 and 2001. In that period of time, 608 fires burned 3,657 acres (1,480 ha) in the park. The amount burned each year ranged from 0.5 acres (0.2 ha) to 1,202 acres (487 ha), with an average of 146 acres (59 ha) per year.

Table 3.7: Number of Fires by Size Class and Cause (1977-2001)

Size Class			**Number of Fires**		
			Human	Lightning	Total
A	**0-0.25 ac**	**0-0.10 ha**	347	172	519
B	**0.26 – 9.9 ac**	**0.11 – 4.0 ha**	17	56	73
C	**10 – 99 ac**	**4.1 – 40 ha**	5	5	10
D	**100 – 299 ac**	**41 – 121 ha**	1	2	3
E	**300 – 999 ac**	**122 – 404 ha**	0	1	1
F	**1,000 – 4,999 ac**	**405 – 2,025 ha**	1	1	2
G	**5,000+ ac**	**2,025+ ha**	0	0	0

Fire Weather Zones and Fire Danger Indices

There are seven fire weather zones on the Olympic Peninsula. Fire weather zone 649 covers the coastal strip. Zone 650 lies just east of zone 649, and influences a small portion of the inland Exclusion Unit. Zone 652 covers the western interior of the peninsula, including the western half of the Wildland Fire Use and inland Exclusion Units. Zone 661 covers the eastern interior of the peninsula, including the eastern half of the Wildland Fire Use and inland Exclusion Units, as well as the Conditional Units. Zone 653 lies

across the north edge and northeast corner of the peninsula. Zone 654 covers the Puget Sound lowlands to the east of the park. Zones 651 and 655 are located south of the park.

National Fire Danger Rating System (NFDRS) indices are used to gage different aspects of fire danger across each fire weather zone. Two indices that are particularly useful in the Olympics are the Energy Release Component (ERC) and the 1000-Hr Fuel Moisture Content. The ERC is a number related to the 24-hr, potential worst case, total energy released per unit area within the flaming front of the fire. It is directly related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. The 1000-Hr Fuel Moisture Content represents the modeled moisture content in the dead fuels in the 3 to 8 inch diameter class and the layer of the forest floor about four inches below the surface. Values can range from 1 to 40 percent.

Table 3.8. NFDRS Indices: 1991-2000 Average

	Zone 649	**Zone 652 West**	**Zone 652 East**
ERC: Average Mid-August	11	17	24
ERC: 90th percentile June 15 – Sept. 30	16	28	39
1000-hr FM: Average Mid-August	25	22	18

See Chapter IV Section C.2.d. for additional discussion of NFDRS indices and graphs of seasonal trends

D.3. THE EXCLUSION UNIT

a. EXCLUSION UNIT: PHYSICAL AND BIOTIC CHARACTERISTICS

The coastal exclusion unit (43,404 acres/17,566 ha) consists of the park's coastal strip. This long, narrow unit is situated between the Pacific Ocean to the west, and private and state-owned lands to the east. The inland exclusion unit (277,441 acres/122,280 ha) consists of an irregularly shaped crescent that encircles most of the Wildland Fire Use Unit, except where there is adjoining Olympic National Forest wilderness along the southeast portion of the park. Varying in width from less than one mile to more than ten miles, the inland exclusion unit provides a protective area between the Wildland Fire Use Unit and non-NPS lands.

The elevation of the exclusion unit ranges from sea level to almost 7,200 feet, but is mostly below 4,000 feet elevation. The topography is hilly along the coast and mountainous inland. At least two major glacial epochs have carved numerous cirques and valleys in the interior, and weathering has eroded many of the mountains into sharp pinnacles and spires. Slopes are generally steep, many in excess of 80%. Numerous streams and rivers radiate in a semicircular drainage pattern, flowing east toward Hood Canal, north into the Strait of Juan de Fuca and west into the Pacific Ocean.

The climate is mild, with wet winters and relatively cool, dry summers. All vegetation zones of the Olympics, except the Douglas-fir Zone, are represented. The higher elevations are in non-forested rock, snow and ice.

The diverse wildlife population includes an estimated 289 avian, 77 mammalian, 14 amphibian, and 4 reptilian species. The number of invertebrate species is unknown, but likely to be very large.

Wildlife occupies a variety of habitats. A key wildlife resource in the park is the assemblage of species that depend on late seral or old growth coniferous forest for all or some of their habitat requirements. Many of these species are either absent or exist in greatly reduced densities outside the park where old

growth is fragmented and sparse (i.e. American marten, pileated woodpecker, northern spotted owl, long-eared myotis, northern goshawk).

Numerous freshwater fish species also inhabit the area. These include: Rainbow/steelhead trout (Oncorhychus mykiss), Cutthroat trout (Oncrohynchus clarki), Coho salmon (Oncorhynchus kisutch), Chum salmon (Oncorhynchus keta), Pink salmon (Oncorhynchus gorbushca), Sockeye salmon (Oncorhynchus nerka), Chinook salmon (Oncorhynchus tshawytscha), Bull trout (Salvelinus confluentus), Dolly Varden (Salvelinus malma), Peamouth (Mylocheilus caurinus), Mountain whitefish (Prosopium williamsoni), Pygmy whitefish (Prosopium coulteri), Pacific lamprey (Lampetra tridentatus), River lamprey (Lampetra ayersi), Western brook lamprey (Lampetra richardsoni), 6 species of freshwater sculpins, Olympic mudminnow (Novumbra hubbsi), Threespine stickleback (Gasterosteus aculeatus), Northern squawfish (Ptychocheilus oregonensis), Longnose dace (Rhinichthys cataractae), Speckled dace (Rhinichthys osculus), Redside shiner (Richardsonius balteatus), Eulachon (Thaleichthys pacificus) and Longnose sucker (Catostomus catostomus). Additionally, the following non-native fish species inhabit park waters: Yellow bullhead (Ictalurus natalis), Eastern brook trout (Salvelinus fontinalis), Largemouth bass (Micropterus salmoides), and Yellow perch (Perca flavescens).

See Wildland Fire Management Plan Environmental Assessment for further discussion of wildlife and fish species.

b. EXCLUSION UNIT: FIRE MANAGEMENT OBJECTIVES

- Contain at least 95% of all fires at less than 10 acres in size.
- Reduce hazard accumulations of fuels around historic and administrative structures to enhance protection of these structures from wildland fire.
- Perform fire research to gain information about fire effects on old-growth Douglas-fir forests in the Morse Creek drainage.
- Perform fire research to determine if Native Americans used fire to enlarge and maintain the coastal prairies.
- Preserve site characteristics at identified locations (e.g., Roose's Prairie and Ahlstrom's Prairie) if research indicates Native American use of fires played a historic and recurring role in shaping the ecosystem.
- Use prescribed fire, in conjunction with other approved methods for vegetative manipulation to maintain those areas that are deemed culturally significant from homestead use (e.g. Higley Homestead and the Smith Place).

c. EXCLUSION UNIT: MANAGEMENT CONSIDERATIONS TO OPERATIONAL IMPLEMENTATION

Safety and Resource Protection

- SAFETY: Provide for firefighter and public safety as the first priority in every fire management activity. Ensure that the 10 Standard Fire Orders and LCES are followed, and the 18 Watch Out Situations are mitigated. Emphasize safety in all aviation operations, felling operations and burnout operations. Ensure compliance with work/rest ratios. Disengage suppression activities immediately if strategies and tactics cannot be implemented safely.

- DEVELOPMENTS: Protect structures and developments from fire, with the stipulation that management actions must keep safety as the number one priority. Management actions must also take into consideration wilderness values, natural and cultural resources, and cost-effectiveness. Suppression activities may be modified or limited to protect ecosystem processes and wilderness values.

- WILDERNESS: Ensure that wilderness resources and wilderness values are considered when developing implementation plans. Use the park's Minimum Requirement Process to help guide the response to wildland fires and the choice of minimum tool in the wilderness. Utilize Olympic National Park's Minimum Impact Tactics and other environmental mitigation measures in all fire management operations.

- NATURAL AND CULTURAL RESOURCES: Manage each fire to minimize environmental damage. To the extent possible, protect historical and cultural resources, rare, sensitive, threatened and endangered species, wetlands, riparian/shoreline areas and sensitive habitats. For all fires known to be near special resources such as archeological sites or rare plant populations, and all fires greater than 10 acres in size, consult with natural and cultural resource management staff to determine if resource advisors should be assigned. Similar precautions should be taken if fire camps, staging areas, or helispots are located near known special resources.

- AIR QUALITY: Manage prescribed and wildland fires in concert with federal, state and local air quality regulations. Ensure that air quality thresholds of NAAQA and visibility requirements are considered in developing implementation plans.

Related Considerations

- HUMAN RESOURCES: Manage human resources in a manner that promotes mutual respect and is free of harassment. Provide training opportunities on incidents when feasible.

- COLLABORATION: Maintain a team approach to fire management at Olympic National Park, where all divisions within the park are represented and assist in the management of fire within the park. Maintain liaison and collaboration with cooperating agencies in all fire management activities, including planning, training, prevention, detection, suppression and research. Establish memoranda of understanding or interagency agreements to integrate fire management activities across agency boundaries.

- PUBLIC INFORMATION: Provide timely and accurate information to visitors, neighbors and employees regarding: fire ecology, the fire management program, fire prevention, fire danger, restrictions and closures. Public information should be conveyed in a manner that avoids unprofessional or emotionally-charged terms. In accordance with NPS policy, information about wildland fires used for resource benefits will not be mixed with information on the status of wildland fire suppression.

- PUBLIC USE: Manage fire operations to minimize disruption to visitor access and local public use.

- COSTS AND LOSSES: Manage fire cost-effectively for the values at risk. Final costs should be no more than 120% of the preferred WFSA alternative. Maximize efforts to utilize local resources and vendors. Manage equipment and supplies to ensure losses are within acceptable fire loss/use rates.

d. EXCLUSION UNIT: HISTORIC ROLE OF FIRE

Coastal Exclusion Unit
Historically, large fires on the coastal portion of the Exclusion Unit have been rare, with a fire return interval on the order of 900 years or longer. This would be characterized as Fire Regime Class V under the system described by Schmidt et al. (2002) and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003). Localized areas, however, show greater evidence of fire, which may have been the result of Native American burning or burning conducted by settlers or loggers. The Government Lands Office maps of the late 1800's show locations of several burned areas along the coastal strip. It is hypothesized that Roose's and Ahlstrom's prairies were enlarged and maintained by Native American burning. With the arrival of homesteaders, some burned areas were utilized for homesteads. Subsequent agriculture and livestock grazing may have maintained these "prairies" and slowed the encroachment of vegetation. This was the situation when some of these sites were assimilated into the park. Brush and trees are now invading the prairies. In recent years, fire occurrence in the Coastal Exclusion Unit has primarily consisted of small, low intensity, human-caused fires in drift logs along the beach or at the beach tree line.

The risk of a wildfire spreading from the heavy fuels on the narrow coastal strip onto lands outside of the park makes it prudent and necessary to suppress all fires. Because of the extremely long fire interval in the coastal strip, fire suppression is not expected to cause significant changes to the vegetation. The risk of losing key ecosystem components is low. Wind will continue to be the primary disturbance factor. Prescribed fire is being considered as a potential tool for maintaining cultural scenes and practices at Ahlstrom's Prairie and Roose's Prairie. Further analysis will be required prior to implementing this tool at these locations.

Interior Exclusion Unit
The Interior Exclusion Unit forms a large crescent that intersects a range of climatic conditions. Along the north section of the crescent, historic fire return intervals varied from less than 100 years up to 500 years. Along the western and southern section of the crescent, historic fire return intervals exceeded 500 years. The Interior Exclusion unit provides a protective area between the Wildland Fire Use Unit and non-NPS lands. All fires in this unit will be suppressed to protect front-country developments and to reduce the risk of wildland fires escaping onto neighboring lands. Over a long period of time (decades or centuries), continued fire suppression may slowly alter the vegetation in this unit, reducing the presence of closely-aged stands of Douglas-fir. Prescribed fire is being considered as a potential tool for maintaining cultural scenes at Higley Homestead and the Smith Place. Further analysis will be required prior to implementation of this tool at these locations. Prescribed fire broadcast burns will be used to research the effects of fire on old-growth Douglas-fir forests in the Morse Creek drainage.

e. EXCLUSION UNIT: WILDLAND FIRE MANAGEMENT SITUATION

Historical Weather Analysis
Olympic National Park's climate is classified as a temperate rainforest. The maritime influence of the Pacific Ocean moderates temperatures on the Olympic Peninsula. Maximum temperatures are generally in the 70's, exceeding 80° and reaching 90° only rarely. Minimum temperatures in the summer are in the 40's and lower 50's. Winter maximum temperatures at lower elevations range from 38°to 45° with minimums of 28° to 35°F. Seldom do temperatures drop below 20° at lower elevations.

Eighty percent of annual precipitation falls from October through March. Precipitation in July and August is less than five percent of the annual total. In northeastern Clallam and Jefferson counties, annual precipitation is often less than 20 inches. On the western slopes of the Olympic Mountains, annual precipitation ranges from 125 to 200 inches. Most winter precipitation falls as rain at elevations below 1,000 ft. and as snow above 2,500 ft. Snow in the mountains generally arrives in October, and remains on the ground until June or July. Snowfall ranges from 8 to 30 inches at low elevations and up to 500 inches near the crest of the Olympic Mountains.

Prevailing winds on the Peninsula are southwest to west in fall and winter, and west and northwest in spring and summer. Hot, dry east winds (subsidence winds) occur more frequently in the late summer and early fall than in the early summer.

The coastal portion of the Exclusion Unit is in fire weather zone 649. The interior portion of the Exclusion Unit is primarily in fire weather zones 652 and 661. Large fires are most likely to occur when there is a combination of dry fine fuels, dry large fuels, and east winds. To monitor the drying of the different size fuels, it is helpful to track both the NFDRS Energy Release Component and 1000-hour Fuel Moisture. See Chapter III Section D.2.b. Table 3.8 NFDRS Indices: 1991-2002 Average and Chapter IV Section C.2.d. for additional discussion of NFDRS indices and graphs of seasonal trends.

Fire Season
Most human-caused fires occur between mid-June and mid-September. Thunderstorms may occur at any time of the year, but rarely cause fires except in July and August. East-wind fire weather is most likely to occur in late summer and early fall.

Fuel Characteristics
In the Exclusion Unit, there is an abundance of large fuels, a dense understory, and deep duff. The predominant fuel types are NFFL Fuel Model 8 and Fuel Model 10. The fuels are rarely dry enough to burn any appreciable acreage except in late summer and early fall. Typical summer fuel moisture values calculated for nearby weather stations are 5-10 percent fuel moisture for 1-hour time lag fuels, and 16-24 percent fuel moisture for 1000-hour time lag fuels. Fuel moistures dip lower than this on dry years.

Fire Regime Alteration
No significant alterations to the fire regime have been identified. Under the classification system described by Schmidt et al., (2002), and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003), the unit's fire regimes would be described as Class IV and V, with fire return intervals ranging from 35 to more than 100 years. It would be characterized as Condition Class 1, with vegetation composition, structure, and fuels similar to those of the historic regime.

Control Problems and Dominant Topographic Features.
The Exclusion Unit has rugged terrain (especially the inland portion of the unit) and heavy fuels. Ground access is difficult in many areas, and aviation support may be needed to detect fires, insert firefighters or deliver water.

This is the unit with the greatest number of human-caused fires due to recreational activities along the coast and in developed areas.

The coastal exclusion unit (43,404 acres/17,566 ha) consists of the park's coastal strip. This long, narrow unit is situated between the Pacific Ocean to the west, and private and state-owned lands to the east. The inland exclusion unit (277,441 acres/122,280 ha) consists of an irregularly shaped crescent that encircles most of the Wildland Fire Use Unit, except where there is adjoining Olympic National Forest wilderness along the southeast portion of the park. Boundaries of the exclusion unit were chosen to capitalize on natural barriers, where fires could be more readily suppressed. Varying in width from less than one mile to more than ten miles, the inland exclusion unit provides a protective area between the Wildland Fire Use Unit and non-NPS lands.

Values to be Protected:

The majority of access roads, trails, developed visitor use areas and administrative facilities are located in the Exclusion Unit. Visitor use is concentrated in developed areas and along trails. Front-country campgrounds, and ranger stations (or visitor centers) are found at Quinault, Queets, Kalaloch, Hoh, Mora, Ozette, Sol Duc, Fairholm, Elwha, Heart of the Hills, Hurricane Ridge, and Deer Park. Backcountry campsites and a few shelters are located along the trail system.

Historic structures or groups of structures are located at Altaire Campground, Elwha Campground and Ranger Station, Headquarters Complex, Crisler's "Hotcakes" Shelter #2, Deer Park Shelters, Skookum Mining Claim, Queets Ranger Station Shed, Lake Crescent Lodge, Pyramid Peak Lookout, Rosemary Inn, Storm King Guard Station, Wendel House, Starbuck Creek Lookout – Cabin, Ahlstom's Homestead, Roose's Homestead, Shaube/Smith Cabin, Graves Creek Ranger Station, Kestner place, and Eagle Guard Station. Archeological sites are scattered throughout the unit. See Chapter X Protection of Sensitive Resources, and the Wildland Fire Management Plan Environmental Assessment for further discussion of cultural resources.

Radio repeaters are located at Kloochman Rock, Peak 6, Hurricane Ridge, and Blue Mountain. (Additional radio repeaters are located outside the park.)

The 350 miles of boundary along the exterior of the unit includes over 200 miles adjacent to managed timberlands.

Five Indian Nations/Reservations are adjacent to or located within the coastal portion of the unit. The Makah Indian Reservation is at the extreme northern end of the unit. The Ozette Reservation near Lake Ozette, the Quileute Reservation near La Push and the Hoh Reservation at the mouth of the Hoh River are surrounded by the park. The Quinault Indian Reservation borders the park south of Kalaloch. Other small settlements are scattered near the coast. Adjacent to the park's Exclusion Zone are the Elwha tribe and Jamestown S'Klallam tribe on the northern boundary and the Skokomish tribe on the southern boundary.

There are approximately 390 pieces of private property within the boundaries of Olympic National Park, and these properties total about 500 acres (200 ha). All of these properties are in the Exclusion Unit. Most of the private property within the park is located at Lake Crescent, Quinault, Ozette, and Oil City, with a few additional properties at Elwha, Heart of the Hills, and along the coastal strip. A number of private structures outside the park are located within one mile of the park boundary. The greatest concentrations are at Lake Dawn, along the Hurricane Ridge Parkway, and Lake Sutherland near Lake Crescent.

More than 90% of the Exclusion Unit is within designated Wilderness.

Four Research Natural Areas (RNA) are within the Exclusion Zone. RNA's preserve discrete plant communities and other natural features for scientific and educational purposes. The four RNA's currently designated are:

Hades Creek-560 acres Bogachiel River drainage
Twin Creek-100 acres Hoh River drainage
Jackson Creek-160 acres Hoh River drainage
Higley Creek-480 acres Quinault River drainage

Five elk exclosures are within the Exclusion Zone. Elk exclosures are fenced study areas, about an acre in size, designed to exclude ungulates, providing opportunities for biologists to compare browsed and unbrowsed ranges. For the purposes of this plan, a six to eight acre exclosure complex defines the actual fenced area and its immediate surrounding area. The five exclosures in the park are:

Kloochman Trail (Big Fir) - Queets River drainage
South Fork Hoh - (2) South Fork Hoh River drainage

Mosquito Creek - Bogachiel River drainage
Hughes Creek - Elwha River drainage.

Several wildlife species listed by the U.S. Fish and Wildlife Service under the Endangered Species Act occur within the vegetation communities of this unit. Listed as threatened are the marbled murrelet (Brachyramphus marmoratus), northern spotted owl (Strix occidentalis caurina), and bald eagle (Haliaeetus leucocephalus). Additionally, the following federally listed endangered or threatened wildlife species may be found in the vicinity of the park: brown pelicans (Pelecanus occidentalis), the short-tailed albatross (Phoebastris albatrus), and the western snowy plover (Charadrius alexandrinus). Other federally listed marine animals occurring in or near the park's coastal area include: the Green sea turtle (Chelonia mydas), the Leatherback sea turtle (Dermochelys coriacea), the Loggerhead sea turtle (Caretta caretta), the Olive ridley sea turtle (Lepidochelys olivacea), the humpback whale (Megaptera novaeangliae), the blue whale (Balaenoptera musculus), the fin whale (Balaenoptera physalus), the sei whale (Balaenoptera borealis), and the sperm whale (Physeter macrocephalus). Also found in the park is the Mazama pocket gopher (Thomomys mazama), a species of concern for Washington State, and a candidate species under the ESA.

The following fish species are listed as threatened or candidate species under the Endangered Species Act: Coastal/Puget Sound (C/PS) bull trout (threatened); Puget Sound (PS) Chinook (threatened); Hood Canal (HC) Summer Chum (threatened); Ozette Lake (OL) Sockeye (threatened); and Puget Sound/Strait of Georgia Coho Salmon (candidate). Additionally, 60 species of groundfish, Chinook salmon and Coho salmon, and five species of coastal pelagic fishes may occur in areas designated as Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act.

The Exclusion Unit is located within a designated Class I area under the Clean Air Act. Legally, the National Park Service has an affirmative responsibility to protect air quality related values, including visibility, and to allow minimal degradation of these values in Class I areas. The park's primary scenic viewpoints (Hurricane Ridge, Hurricane Hill, Lookout Rock and Deer Park) lie on the border of this unit.

See Chapter X Protection of Sensitive Resources and Wildland Fire Management Plan Environmental Assessment for further discussion of sensitive resources such as: designated Wilderness; threatened and endangered species, and air resources.

D.4. THE CONDITIONAL UNIT

a. CONDITIONAL UNIT: PHYSICAL AND BIOTIC CHARACTERISTICS

The topography is mountainous with deep valleys and numerous high peaks. The elevation ranges from less than 800 feet above sea level, to over 7,000 feet. At least two major glacial epochs have carved numerous cirques and valleys and weathering has eroded many of the mountains into sharp pinnacles and spires. Slopes are generally steep, many in excess of 80%. Streams and rivers flow north into the Strait of Juan de Fuca and east/southeast into Hood Canal.

The climate is mild with wet winters and relatively cool, dry summers. All of the vegetation zones of the Olympics, except the Sitka Spruce Zone, are represented in the Conditional Unit. The higher elevations of the unit are non-forested rock, snow and ice.

The diverse wildlife population includes an estimated 289 avian, 77 mammalian, 14 amphibian, and 4 reptilian species. The number of invertebrate species is unknown, but likely to be very large. In recent years the only invertebrate inventory contracted by the park was an assessment of butterflies in the coastal prairies. In that effort, several rare taxa were found, along with one that is potentially new to science.

Wildlife occupy a variety of habitats. A key wildlife resource in the park is the assemblage of species that depend on late seral or old growth coniferous forest for all or some of their habitat requirements. Many of these species are either absent or exist in greatly reduced densities outside the park where old growth is fragmented and sparse (i.e. American marten, pileated woodpecker, northern spotted owl, marbled murrelet, long-eared myotis, northern goshawk).

Numerous freshwater fish species also inhabit the area. These include: Rainbow/steelhead trout (Oncorhychus mykiss), Cutthroat trout (Oncrohynchus clarki), Coho salmon (Oncorhynchus kisutch), Chum salmon (Oncorhynchus keta), Pink salmon (Oncorhynchus gorbushca), Sockeye salmon (Oncorhynchus nerka), Chinook salmon (Oncorhynchus tshawytscha), Bull trout (Salvelinus confluentus), Dolly Varden (Salvelinus malma), Peamouth (Mylocheilus caurinus), Mountain whitefish (Prosopium williamsoni), Pygmy whitefish (Prosopium coulteri), Pacific lamprey (Lampetra tridentatus), River lamprey (Lampetra ayersi), Western brook lamprey (Lampetra richardsoni), 6 species of freshwater sculpins, Olympic mudminnow (Novumbra hubbsi), Threespine stickleback (Gasterosteus aculeatus), Northern squawfish (Ptychocheilus oregonensis), Longnose dace (Rhinichthys cataractae), Speckled dace (Rhinichthys osculus), Redside shiner (Richardsonius balteatus), Eulachon (Thaleichthys pacificus) and Longnose sucker (Catostomus catostomus). Additionally, the following non-native fish species inhabit park waters: Yellow bullhead (Ictalurus natalis), Eastern brook trout (Salvelinus fontinalis), Largemouth bass (Micropterus salmoides), and Yellow perch (Perca flavescens).

See Chapter X Protection of Sensitive Resources and Wildland Fire Management Plan Environmental Assessment for further discussion of wildlife and fish species.

b. CONDITIONAL UNIT: FIRE MANAGEMENT OBJECTIVES

- To the extent possible within the constraints detailed in this plan, maintain the role of fire within the natural range of variability for the ecosystem. Fire intensity may range from low-to-moderate intensity fires that burn through the understory, to high-intensity, stand-replacing fires. Fire size may range from less than an acre to several hundred acres.

- Limit wildland fire use (in the Wildland Fire Use and Conditional Unit combined) to 200 acres (81 ha) per year in areas where there is suitable habitat for Northern Spotted Owls or Marbled Murrelets, with an allowance for an additional 600 acres (243 ha) to be managed as wildland fire use in one year out of five. In addition, limit wildland fire use to 500 acres (202 ha) per year in areas outside of suitable habitat. Wildland Fire Use that has potential to exceed these acreage figures, but meets all other wildland fire use criteria, will be considered candidates for wildland fire use management only with additional environmental analysis and consultation.

- Contain at least 95% of unwanted fires (human-caused fires and fires which do not meet criteria for wildland fire use) at less than 10 acres in size.

- Ensure that wildland fires are contained within the Conditional and Wildland Fire Use Unit, unless agreements have been established to allow joint management of wildland fire across agency boundaries (Conditional Unit only). Take holding or suppression action on wildland fires that have the potential to threaten private lands or neighboring public lands.

- Reduce hazard accumulations of fuels around historic and administrative structures to enhance protection of these structures from wildland fire.

c. CONDITIONAL UNIT: MANAGEMENT CONSIDERATIONS TO OPERATIONAL

IMPLEMENTATION

Safety and Resource Protection

- SAFETY: Provide for firefighter and public safety as the first priority in every fire management activity. Ensure that the 10 Standard Fire Orders and LCES are followed, and the 18 Watch Out Situations are mitigated. Emphasize safety in all aviation operations, felling operations and burnout operations. Ensure compliance with work/rest ratios. Disengage suppression activities immediately if strategies and tactics cannot be implemented safely.

- DEVELOPMENTS: Protect major structures and developments from fire, with the stipulation that management actions must keep safety as the number one priority. Management actions must also take into consideration wilderness values, natural and cultural resources, and cost-effectiveness. Suppression activities may be modified or limited to protect ecosystem processes and wilderness values.

- WILDERNESS: Ensure that wilderness resources and wilderness values are considered when developing implementation plans. Use the park's Minimum Requirement Process to help guide the response to wildland fires and the choice of minimum tool in the wilderness. Utilize Olympic National Park's Minimum Impact Tactics and other environmental mitigation measures in all fire management operations.

- NATURAL AND CULTURAL RESOURCES: Manage each fire to minimize environmental damage. To the extent possible, protect historical and cultural resources, rare, sensitive, threatened and endangered species, wetlands, riparian/shoreline areas and sensitive habitats. For all fires known to be near special resources such as archeological sites or rare plant populations, and all fires greater than 10 acres in size, consult with natural and cultural resource management staff to determine if resource advisors should be assigned. Similar precautions should be taken if fire camps, staging areas or helispots are located near known special resources.

- AIR QUALITY: Manage prescribed and wildland fires in concert with federal, state and local air quality regulations. Ensure that air quality thresholds of NAAQA and visibility requirements are considered in developing implementation plans.

- MONITORING: Monitor all wildland fire use actions:
  - to ensure protection of human life, property, and natural/cultural resources;
  - to assist with contingency planning;
  - to gain information about fire behavior and fire effects; and,
  - to monitor smoke emissions for identification of health concerns

Related Considerations

- HUMAN RESOURCES: Manage human resources in a manner that promotes mutual respect and is free of harassment. Provide training opportunities on incidents when feasible.

- COLLABORATION: Maintain a team approach to fire management at Olympic National Park, where all divisions within the park are represented and assist in the management of fire within the park. Maintain liaison and collaboration with cooperating agencies in all fire management activities, including planning, training, prevention, detection, suppression and research. Establish memoranda of understanding or interagency agreements to integrate fire management activities across agency boundaries.

- PUBLIC INFORMATION: Provide timely and accurate information to visitors, neighbors and employees regarding: fire ecology, the fire management program, fire prevention, fire danger, restrictions and closures. Public information should be conveyed in a manner that avoids unprofessional or emotionally-charged terms. In accordance with NPS policy, information about wildland fires used for resource benefits will not be mixed with information on the status of wildland fire suppression.

- PUBLIC USE: Manage fire operations to minimize disruption to visitor access and local public use.

- COSTS AND LOSSES: Manage fire cost-effectively for the values at risk. Final costs should be no more than 120% of the preferred WFSA alternative. Maximize efforts to utilize local resources and vendors. Manage equipment and supplies to ensure losses are within acceptable fire loss/use rates.

d. CONDITIONAL UNIT: HISTORIC ROLE OF FIRE

The fire return interval ranges from less than 200 years on the northeast portion of the unit to more than 500 years on the south portion of the unit. Large, closely-aged patches of forest dominated by Douglas-fir are evidence of stand replacement fires that occurred in the past. The fire regimes of the Conditional Unit would be characterized as Fire Regime Class IV or V under the classification system described by Schmidt et al. (2002) and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003).

e. CONDITIONAL UNIT: WILDLAND FIRE MANAGEMENT SITUATION

Historical Weather Analysis

The climate is similar to the Exclusion Unit, with mild, wet winters and relatively cool, dry summers. Precipitation amounts are generally lower in the Conditional Unit, because much of the unit lies in the rain shadow of the Olympic mountains.

The Conditional Unit is primarily in fire weather zone 661, with a small portion of lands in zone 652. Large fires are most likely to occur when there is a combination of dry fine fuels, dry large fuels, and east winds. To monitor the drying of the different size fuels, it is helpful to track both the NFDRS Energy Release Component and 1000-hour Fuel Moisture.

See Chapter III Section D.2.b. Table 3.8 NFDRS Indices: 1991-2002 Average, and Chapter IV Section C.2.d. for additional discussion of NFDRS indices and graphs of seasonal trends.

Fire Season
Most fires (both human-caused and lightning-caused) occur between mid-June and mid-September. Lightning-caused fires occur most frequently in July and August. East-wind fire weather is most likely to occur in September and October.

Fuel Characteristics
In the Conditional Unit there is an abundance of large fuels, a dense understory, and deep duff. The predominant fuel types are NFFL Fuel Model 8 and Fuel Model 10. The fuels are rarely dry enough to burn any appreciable acreage except in mid-to-late summer and early fall. Typical summer fuel moisture values calculated for nearby weather stations are 5-10 percent fuel moisture for 1-hour time lag fuels, and 16-24 percent fuel moisture for 1000-hour time lag fuels. Fuel moistures dip lower than this on dry years.

Fire Regime Alteration

No significant alterations to the fire regime have been identified. Under the classification system described by Schmidt et al., (2002) and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003), the unit's fire regimes would be described as Class IV and V, with fire return intervals ranging from 35 years to more than 100 years. It would be characterized as Condition Class 1, with vegetation composition, structure, and fuels similar to those of the historic regime.

Control Problems and Dominant Topographic Features
The Conditional Unit is located along the southeast portion of the park between the park's Wildland Fire Use Unit and Olympic National Forest (USFS) lands. It includes a portion of the Gray Wolf, Dungeness, Dosewallips, Duckabush and Skokomish drainages.

Most of this unit adjoins USFS wilderness. The terrain is rugged and fuels are heavy. Ground access is difficult in many areas, and aviation support may be needed to detect fires, insert firefighters or deliver water.

Human-caused fires occur most frequently near trails and campsites.

Values to be Protected:
The Conditional Unit is bordered by Olympic National Forest lands to the east and south. Fires in the Conditional Unit may not be permitted to cross outside of park boundaries unless agreements are in place with the Forest Service to allow joint management of wildland fires across agency boundaries.

Visitor use in the Conditional Unit is usually concentrated near developed campgrounds, maintained trails, and backcountry campsites in the following drainages: Royal Creek, Heather Creek, Dosewallips, Duckabush, Hamma Hamma, and Skokomish, Seasonally used ranger stations in the most heavily used areas include Royal Creek Ranger Camp, Dosewallips Ranger Station, Staircase Ranger Station, and Flapjack Ranger Camp.

Archeological sites are scattered throughout the unit. See Chapter X Protection of Sensitive Resources, and the Wildland Fire Management Plan Environmental Assessment for further discussion of cultural resources.

More than 95% of the Conditional Unit is within designated Wilderness.

Several wildlife species listed by the U.S. Fish and Wildlife Service under the Endangered Species Act occur within the vegetation communities of this unit. Listed as threatened are the marbled murrelet (Brachyramphus marmoratus), northern spotted owl (Strix occidentalis caurina) and bald eagle (Haliaeetus leucocephalus). Additionally, the following federally listed endangered or threatened wildlife species may be found in the vicinity of the park: brown pelicans (Pelecanus occidentalis), the short-tailed albatross (Phoebastris albatrus), and the western snowy plover (Charadrius alexandrinus). Also found in the park is the Mazama pocket gopher (Thomomys mazama), a species of concern for Washington State, and a candidate species under the ESA.

The following fish species are listed as threatened or candidate species under the Endangered Species Act: Coastal/Puget Sound (C/PS) bull trout (threatened); Puget Sound (PS) Chinook (threatened); Hood Canal (HC) Summer Chum (threatened); Ozette Lake (OL) Sockeye (threatened); and Puget Sound/Strait of Georgia Coho Salmon (candidate). Additionally, 60 species of groundfish, Chinook salmon and Coho salmon, and five species of coastal pelagic fishes may occur in areas designated as Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act.

The Conditional Unit is located within a designated Class I Area under the Clean Air Act. Legally, the National Park Service has an affirmative responsibility to protect air quality related values, including visibility, and to allow minimal degradation of these values in Class I areas. The park's primary scenic viewpoints (Hurricane Ridge, Hurricane Hill, Lookout Rock and Deer Park) lie on the border of this unit.

See Chapter X Protection of Sensitive Resources, and the Wildland Fire Management Plan Environmental Assessment for further discussion of sensitive resources such as: designated Wilderness; threatened and endangered species, and air resources.

D.5. THE WILDLAND FIRE USE UNIT

a. WILDLAND FIRE USE UNIT: PHYSICAL AND BIOTIC CHARACTERISTICS

The topography is mountainous with deep valleys and numerous high peaks. The elevation ranges from less than 400 feet above sea level, to almost 8,000 feet. At least two major glacial epochs have carved numerous cirques and valleys and weathering has eroded many of the mountains into sharp pinnacles and spires. Slopes are generally steep, many in excess of 80%. Numerous streams and rivers radiate in a semicircular drainage pattern, flowing east toward Hood Canal, north into the Strait of Juan de Fuca and west into the Pacific Ocean.

The climate is mild, with wet winters and relatively cool, dry summers. All vegetation zones of the Olympics, except the Douglas-fir Zone, are represented. The higher elevations are in non-forested rock, snow and ice.

The diverse wildlife population includes an estimated 289 avian, 77 mammalian, 14 amphibian, and 4 reptilian species. The number of invertebrate species is unknown, but likely to be very large.

Wildlife occupies a variety of habitats. A key wildlife resource in the park is the assemblage of species that depend on late seral or old growth coniferous forest for all or some of their habitat requirements. Many of these species are either absent or exist in greatly reduced densities outside the park where old growth is fragmented and sparse (i.e. American marten, pileated woodpecker, northern spotted owl, marbled murrelet, long-eared myotis, northern goshawk).

Numerous freshwater fish species also inhabit the area. These include: Rainbow/steelhead trout (Oncorhychus mykiss), Cutthroat trout (Oncrohynchus clarki), Coho salmon (Oncorhynchus kisutch), Chum salmon (Oncorhynchus keta), Pink salmon (Oncorhynchus gorbushca), Sockeye salmon (Oncorhynchus nerka), Chinook salmon (Oncorhynchus tshawytscha), Bull trout (Salvelinus confluentus), Dolly Varden (Salvelinus malma), Peamouth (Mylocheilus caurinus), Mountain whitefish (Prosopium williamsoni), Pygmy whitefish (Prosopium coulteri), Pacific lamprey (Lampetra tridentatus), River lamprey (Lampetra ayersi), Western brook lamprey (Lampetra richardsoni), 6 species of freshwater sculpins, Olympic mudminnow (Novumbra hubbsi), Threespine stickleback (Gasterosteus aculeatus), Northern squawfish (Ptychocheilus oregonensis), Longnose dace (Rhinichthys cataractae), Speckled dace (Rhinichthys osculus), Redside shiner (Richardsonius balteatus), Eulachon (Thaleichthys pacificus) and Longnose sucker (Catostomus catostomus). Additionally, the following non-native fish species inhabit park waters: Yellow bullhead (Ictalurus natalis), Eastern brook trout (Salvelinus fontinalis), Largemouth bass (Micropterus salmoides), and Yellow perch (Perca flavescens).

See Chapter X Protection of Sensitive Resources, and the Wildland Fire Management Plan Environmental Assessment for further discussion of wildlife and fish species.

b. WILDLAND FIRE USE UNIT: FIRE MANAGEMENT OBJECTIVES

- To the extent possible within the constraints detailed in this plan, maintain the role of fire within the natural range of variability for the ecosystem. Fire intensity may range from low-to-moderate intensity fires that burn through the understory, to high-intensity, stand-replacing fires. Fire size may range from less than an acre to several hundred acres.

- Limit wildland fire use (in the Wildland Fire Use and Conditional Unit combined) to 200 acres (81 ha) per year in areas where there is suitable habitat for Northern Spotted Owls or Marbled Murrelets, with an allowance for an additional 600 acres (243 ha) to be managed as wildland fire use in one year out of five. In addition, limit wildland fire use to 500 acres (202 ha) per year in areas outside of suitable habitat. Wildland Fire Use that has potential to exceed these acreage figures, but meets all other wildland fire use criteria, will be considered candidates for wildland fire use management only with additional environmental analysis and consultation.

- Contain at least 95% of unwanted fires (human-caused fires and fires which do not meet criteria for wildland fire use) at less than 10 acres in size.

- Ensure that wildland fires are contained within the Conditional and Wildland Fire Use Unit, unless agreements have been established to allow joint management of wildland fire across agency boundaries (Conditional Unit only). Take holding or suppression action on wildland fires that have the potential to threaten private lands or neighboring public lands.

- Reduce hazard accumulations of fuels around historic and administrative structures to enhance protection of these structures from wildland fire.

c. WILDLAND FIRE USE UNIT: MANAGEMENT CONSIDERATIONS TO OPERATIONAL IMPLEMENTATION

Safety and Resource Protection

- SAFETY: Provide for firefighter and public safety as the first priority in every fire management activity. Ensure that the 10 Standard Fire Orders and LCES are followed, and the 18 Watch Out Situations are mitigated. Emphasize safety in all aviation operations, felling operations and burnout operations. Ensure compliance with work/rest ratios. Disengage suppression activities immediately if strategies and tactics cannot be implemented safely.

- DEVELOPMENTS: Protect major structures and developments from fire, with the stipulation that management actions must keep safety as the number one priority. Management actions must also take into consideration wilderness values, natural and cultural resources, and cost-effectiveness. Suppression activities may be modified or limited to protect ecosystem processes and wilderness values.

- WILDERNESS: Ensure that wilderness resources and wilderness values are considered when developing implementation plans. Use the park's Minimum Requirement Process to help guide the response to wildland fires and the choice of minimum tool in the wilderness. Utilize Olympic National Park's Minimum Impact Tactics and other environmental mitigation measures in all fire management operations.

- NATURAL AND CULTURAL RESOURCES: Manage each fire to minimize environmental damage. To the extent possible, protect historical and cultural resources, rare, sensitive, threatened and endangered species, wetlands, riparian/shoreline areas and sensitive habitats. For all fires known

to be near special resources such as archeological sites or rare plant populations, and all fires greater than 10 acres in size, consult with natural and cultural resource management staff to determine if resource advisors should be assigned. Similar precautions should be taken if fire camps, staging areas, or helispots are located near known special resources.

- AIR QUALITY: Manage prescribed and wildland fires in concert with federal, state and local air quality regulations. Ensure that air quality thresholds of NAAQA and visibility requirements are considered in developing implementation plans.

- MONITORING: Monitor all wildland fire use actions:
  - To ensure protection of human life, property, and natural/cultural resources;
  - To assist with contingency planning;
  - To gain information about fire behavior and fire effects; and,
  - To monitor smoke emissions for identification of health concerns

Related Considerations

- HUMAN RESOURCES: Manage human resources in a manner that promotes mutual respect and is free of harassment. Provide training opportunities on incidents when feasible.

- COLLABORATION: Maintain a team approach to fire management at Olympic National Park, where all divisions within the park are represented and assist in the management of fire within the park. Maintain liaison and collaboration with cooperating agencies in all fire management activities, including planning, training, prevention, detection, suppression and research. Establish memoranda of understanding or interagency agreements to integrate fire management activities across agency boundaries.

- PUBLIC INFORMATION: Provide timely and accurate information to visitors, neighbors and employees regarding: fire ecology, the fire management program, fire prevention, fire danger, restrictions and closures. Public information should be conveyed in a manner that avoids unprofessional or emotionally-charged terms. In accordance with NPS policy, information about wildland fires used for resource benefits will not be mixed with information on the status of wildland fire suppression.

- PUBLIC USE: Manage fire operations to minimize disruption to visitor access and local public use.

- COSTS AND LOSSES: Manage fire cost-effectively for the values at risk. Final costs should be no more than 120% of the preferred WFSA alternative. Maximize efforts to utilize local resources and vendors. Manage equipment and supplies to ensure losses are within acceptable fire loss/use rates.

d. WILDLAND FIRE USE UNIT: HISTORIC ROLE OF FIRE

The fire return interval ranges from less than 200 years along the north and northeast portion of the unit to more than 500 years on the southwest portion of the unit. Large, closely-aged patches of forest dominated by Douglas-fir are evidence of stand replacement fires that occurred in the past. The fire regimes of the Wildland Fire Use Unit would be characterized as Fire Regime Class IV or V under the classification system described by Schmidt et al. (2002) and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003).

e. WILDLAND FIRE USE UNIT: WILDLAND FIRE MANAGEMENT SITUATION

Historical Weather Analysis

Olympic National Park's climate is classified as a temperate rainforest. The maritime influence of the Pacific Ocean moderates temperatures on the Olympic Peninsula. Maximum temperatures are generally in the 70's, exceeding 80° and reaching 90° only rarely. Minimum temperatures in the summer are in the 40's and lower 50's. Winter maximum temperatures at lower elevations range from 38°to 45° with minimums of 28° to 35°F. Seldom do temperatures drop below 20° at lower elevations.

Eighty percent of annual precipitation falls from October through March. Precipitation in July and August is less than five percent of the annual total. In northeastern Clallam and Jefferson counties, annual precipitation is often less than 20 inches. On the western slopes of the Olympic Mountains, annual precipitation ranges from 125 to 200 inches. Most winter precipitation falls as rain at elevations below 1,000 ft. and as snow above 2,500 ft. Snow in the mountains generally arrives in October, and remains on the ground until June or July. Snowfall ranges from 8 to 30 inches at low elevations and up to 500 inches near the crest of the Olympic Mountains.

Prevailing winds on the Peninsula are southwest to west in fall and winter, and west and northwest in spring and summer. Hot, dry east winds (subsidence winds) occur more frequently in the late summer and early fall than in the early summer.

The Wildland Fire Use Unit is located in fire weather zones 652 and 661. Large fires are most likely to occur when there is a combination of dry fine fuels, dry large fuels, and east winds. To monitor the drying of the different size fuels, it is helpful to track both the NFDRS Energy Release Component and 1000-hour fuel moisture.

See Chapter III Section D.2.b. Table 3.8 NFDRS Indices: 1991-2002 Average, and Chapter IV Section C.2.d. for additional discussion of NFDRS indices and graphs of seasonal trends.

Fire Season
Most fires (both human-caused and lightning-caused) occur between mid-June and mid-September. Lightning-caused fires occur most frequently in July and August. East-wind fire weather is most likely to occur in late summer and early fall.

Fuel Characteristics
In the Wildland Fire Use Unit there is an abundance of large fuels, a dense understory, and deep duff. The predominant fuel types are NFFL Fuel Model 8 and Fuel Model 10. The fuels are rarely dry enough to burn any appreciable acreage except in mid-to-late summer and early fall. Typical summer fuel moisture values, calculated for nearby weather stations are 5-10 percent fuel moisture for 1-hour time lag fuels, and 16-24 percent fuel moisture for 1000-hour time lag fuels. Fuel moistures dip lower than this on dry years.

Fire Regime Alteration
Although there has been active fire suppression for almost a century, no significant alterations to the fire regime have been identified. Under the classification system described by Schmidt et al., (2002) and supplemented by guidance from the Department of the Interior Assistant Secretary – Policy, Management and Budget (2003), the unit's fire regimes would be described as Class IV and V, with fire return intervals ranging from 35 years to more than 100 years. It would be characterized as Condition Class 1, with vegetation composition, structure, and fuels similar to those of the historic regime.

Control Problems and Dominant Topographic Features
The Wildland Fire Use Unit consists of the rugged and remote interior of the park. In this unit, drainages radiate from a central core of mountains. The major drainages include Quinault, Queets, Hoh, Soleduck, Elwha, Dungeness, Dosewallips, Duckabush, and Skokomish.

The unit has rugged terrain and heavy fuels. Ground access is difficult in many areas, and aviation support may be needed to detect lightning fires, insert firefighters or deliver water.

Human-caused fires occur most frequently near trails and campsites.

Values to be Protected:
This unit borders the front country areas of Hurricane Ridge and Deer Park. Visitor use in the Wildland Fire Use Unit is usually concentrated near the front country facilities, maintained trails and backcountry campsites. Seasonally used ranger stations in the most heavily used areas include: Low Divide Ranger Station, Enchanted Valley Chalet, Olympus Guard Station, Glacier Meadows Ranger Camp, Deer Lake Ranger Camp, Seven Lakes Basin Ranger Camp, Elkhorn Ranger Station, Hayes River Ranger Station, Grand Valley Ranger Camp, and Honeymoon Meadows Ranger Camp. A few shelters and outhouses are scattered in the backcountry.

Historic structures or groups of structures are located at: Crisler's "Hotcakes" Shelter, Dodger Point Fire Lookout, Elk Lick Lodge (Remanns Cabin), Elkhorn Ranger Station, Hayes River Fire Cache, Humes Ranch, Michael's Cabin, Twenty-one Mile Shelter, Happy Four Shelter, Hyak Shelter, Olympus Guard Station, Graywolf Falls Shelter, Three Forks Shelter, Pelton Creek Shelter, Canyon Creek Shelter, Crisler's Castle-in-the-Cat, Enchanted Valley Chalet, Low Divide Shelter, North Fork Guard Station, Trapper Shelter, North Fork Soleduck Shelter, Anderson Pass Shelter, and Home Sweet Home Shelter. Archeological sites are scattered throughout the unit. See Chapter X Protection of Sensitive Resources, and the Wildland Fire Management Plan Environmental Assessment for further discussion of cultural resources.

Muncaster and Elk Lick radio repeaters are located in this unit.

More than 95% of the Wildland Fire Use Unit is within designated Wilderness.

Several wildlife species listed by the U.S. Fish and Wildlife Service under the Endangered Species Act occur within the vegetation communities of this unit. Listed as threatened are the marbled murrelet (Brachyramphus marmoratus), northern spotted owl (Strix occidentalis caurina), and bald eagle (Haliaeetus leucocephalus). Additionally, the following federally listed endangered or threatened wildlife species may be found in the vicinity of the park: brown pelicans (Pelecanus occidentalis), the short-tailed albatross (Phoebastris albatrus), and the western snowy plover (Charadrius alexandrinus). Also found in the park is the Mazama pocket gopher (Thomomys mazama), a species of concern for Washington State, and a candidate species under the ESA.

The following fish species are listed as threatened or candidate species under the Endangered Species Act: Coastal/Puget Sound (C/PS) bull trout (threatened); Puget Sound (PS) Chinook (threatened); Hood Canal (HC) Summer Chum (threatened); Ozette Lake (OL) Sockeye (threatened); and Puget Sound/Strait of Georgia Coho Salmon (candidate). Additionally, 60 species of groundfish, Chinook salmon and Coho salmon, and five species of coastal pelagic fishes may occur in areas designated as Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act.

The Wildland Fire Use Unit is located within a designated Class I Area under the Clean Air Act. Legally, the National Park Service has an affirmative responsibility to protect air quality related values, including visibility, and to allow minimal degradation of these values in Class I Areas. The park's primary scenic viewpoints (Hurricane Ridge, Hurricane Hill, Lookout Rock and Deer Park) lie on the border of this unit.

See Chapter X Protection of Sensitive Resources, and the Wildland Fire Management Plan Environmental Assessment for further discussion of sensitive resources such as: designated Wilderness; threatened and endangered species, and air resources.

CHAPTER IV
Wildland Fire Management Program Components

The fire management plan is comprised of the following wildland fire management components that define the wildland fire program: General Implementation Procedures, Wildland Fire Suppression, Wildland Fire Use, Prescribed Fire, Non-Fire Fuel Treatment Applications, and Emergency Rehabilitation and Restoration.

A. GENERAL IMPLEMENTATION PROCEDURES

All fires not ignited by managers for specific purposes are considered as wildland fires. The appropriate management response to each fire may vary from fire to fire and even along the perimeter of an individual fire. The options range from monitoring with minimal on-the-ground actions to intense suppression actions on all or portions of the fire perimeter. The appropriate management response is developed from analysis of the local situation, values-to-be-protected, management objectives, external concerns and land use. Fires that do not meet criteria to be managed for resource benefits will receive an initial attack suppression action.

The FMO ensures that a Wildland Fire Implementation Plan (WFIP) is prepared for each wildland fire. The WFIP is a progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response to a wildland fire. Specific WFIP requirements are outlined in the Wildland Fire Use Implementation Procedures Reference Guide (2005).

The WFIP Stage I: Initial Fire Assessment provides the decision framework for selecting the appropriate management response. It documents the current and predicted situation, documents all appropriate administrative information, and aids managers by providing them with decision criteria to make the initial decision whether to manage the fire for resource benefits or to take suppression action. The Initial Fire Assessment includes the Fire Situation and the Decision Criteria Checklist. The OLYM Decision Chart augments the Decision Criteria Checklist and provides historic fire danger/fire behavior thresholds to expedite the decision-making process. See Chapter IV Section C for further information on the decision criteria. Resource protection concerns that must be considered include impacts to scenic viewpoints, air quality (especially Designated Areas and Smoke Sensitive Areas), historic structures, archeological sites, threatened and endangered species and their habitat (especially bald eagle, marbled murrelet, pocket gophers, and various fish species), and biologically significant sites (especially where there are rare plants). In locations or circumstances where suppression is the only appropriate response (as in the Exclusion Unit), the requirement for a decision checklist as part of the Stage I analysis is considered to be met.

In the Wildland Fire Use and Conditional Units, many wildland fires occur in high elevations, remote areas, or areas surrounded by sparse fuels, and have little or no chance of ever requiring any management action other than monitoring. They are often single tree fires, or may be larger but surrounded by strong natural barriers. These fires may require only a WFIP Stage I: Initial Fire Assessment and Periodic Fire Assessment. If the Fire Management Officer or designee determines that this is the case, the decision process, analysis of alternatives, and daily re-certification checklist will be the record of decision. If, at a later date, it develops that additional management will be needed, such as firing, holding, or trail closures, additional stages of the Wildland Fire Implementation Plan detailing the management strategy and planned implementation actions for the fire will be submitted to the superintendent or acting superintendent for review and approval.

B. WILDLAND FIRE SUPPRESSION

B.1. RANGE OF POTENTIAL FIRE BEHAVIOR

Depending on site specific fuels, weather and topography, fire behavior in the Olympics can range from smoldering, creeping fires that burn less than ¼ acre, to intense crown fires covering hundreds of acres. In the past 25 years 85% of all fires have been less than ¼ acre (Class A) in size. In the same period there have been two fires (one human-caused, and one lightning-caused) that burned more than 1000 acres. Large fires may burn for weeks but make their major runs during a few days of east wind weather when the temperature is high and the relative humidity is low. In the eastern Olympics an occasional fire of lower intensity may burn through the understory without killing the overstory (Wetzel and Fonda, 2000).

On average, approximately 15-20 human-caused fires are recorded each year, with a higher incidence on drier years.

Lightning storms are typically followed by light to moderate amounts of precipitation. The rainfall may extinguish the fires, while high fuel moisture inhibits spread. However, prolonged periods of warm, dry weather, especially in combination with east winds, often reveal numerous latent "sleepers." The Hoh Fire (1978), which grew to over 1000 acres, was discovered 13 days following known ignition; and the Chimney Fire (1981), which grew to 500 acres, was discovered 23 days after probable ignition.

Table 4.1: Number of Fires by Size Class and Cause (1977-2001)

Size Class			Number of Fires		
			Human	Lightning	Total
A	0-0.25 ac	0-0.10 ha	347	172	519
B	0.26 – 9.9 ac	0.11 – 4.0 ha	17	56	73
C	10 – 99 ac	4.1 – 40 ha	5	5	10
D	100 – 299 ac	41 – 121 ha	1	2	3
E	300 – 999 ac	122 – 404 ha	0	1	1
F	1,000 – 4,999 ac	405 – 2,025 ha	1	1	2
G	5,000+ ac	2,025+ ha	0	0	0

B.2. PREPAREDNESS ACTIONS

a. FIRE PREVENTION ACTIVITIES

See Appendix N – Fire Prevention Action Plan.

b. ANNUAL TRAINING, MEDICAL STANDARDS AND DRUG TESTING

Insuring that Olympic's staff receives adequate fire training is the responsibility of the Fire Management Officer. The training objectives are specified in the Park's Fire Training Needs Analysis, which is formulated jointly with the Regional Fire Management Office and updated annually. Olympic will maintain trained personnel to staff a multi-resource (Type 3) organizational level. Due to the limited number of park staff, other agency personnel may be required to fill out the Type 3 organization during incidents, due to vacancies, personnel on leave, other assignments, etc. Current training requirements are outlined in the Wildland Fire Qualifications Subsystem Guide (PMS 310-1) that describes necessary training, experience and physical fitness requirements for the various fire positions. Task books will be utilized to document trainee assignments.

Basic wildland firefighter training (S-130/190) will be offered at the beginning of each summer. It is recommended that all employees of the Resource Protection and Visitor Services Division, who have not had previous fire training, that are physically capable, and are interested will attend. Other division employees and prospective emergency hire personnel (SCA's, VIP's, etc.) will be encouraged and permitted to attend, as interest and funding permits. All potential paid park firefighters must successfully pass an arduous duty fire physical and a mandatory drug test before taking the training and the arduous duty pack test. SCA's and VIP's are currently exempt from the physical and drug test requirement, as they are hired as AD firefighters. SCA's and VIP's are required to complete a medical screening form prior to attempting the pack test. Fire personnel, members of the permanent ranger staff and an interagency cadre will instruct the training sessions. Additional training may be given in urban interface fire protection, pump and engine operation, helicopter safety and fire monitoring, as needed. Extensive on-the-job training is encouraged and conducted at the field level.

Annual Firefighter Refresher training is also presented at the beginning of every summer. Every red-carded employee is required to attend a refresher training session each season prior to any fire assignments. Firefighter refresher training is good for 12 months from the time taken.

In addition to the standard course materials, all firefighters will receive instruction on the following topics, during basic fire training and/or during refresher training:
1. Purpose and objectives of the fire management program.
2. Fire ecology in park ecosystems.
3. Information regarding appropriate considerations and constraints to protect wilderness values and endangered species during suppression operations.
4. Identification of and impacts on cultural resources during firefighting operations.
5. Lessons learned from previous fire incidents.
6. Other topics currently required by the Regional or National Office.

The Fire Management Officer will provide training to Communications Center personnel in fire dispatch procedures, if needed.

The park supports the development of individual Type 1 and 2 overhead personnel from among qualified and experienced park staff for assignment to interagency overhead teams at the regional and national level.

The Fire Program Assistant maintains information regarding employee fire training, experience and qualifications in the IQCS computer system and in hard copy files kept in the fire management office.

c. READINESS OF EQUIPMENT AND SUPPLIES

The park currently maintains four wildland fire engines. There are three Type 6 engines and one Type 3 engine, all capable of foam production. The engines are located at Port Angeles (Type 3), Lake Crescent (Type 6), Kalaloch (Type 6) and Elwha (Type 6, not staffed, reserve engine). The engines (except Elwha) are staffed five days-a-week with seasonal staff.. The engines are designed for wildfire suppression, but can be utilized for structural fire support to provide exterior protection during evacuation and rescue, protect building exposures and stop fire spread as a supplement to structural engine, fixed-hose and standpipe systems. Only the Type 3 and the Lake Crescent Type 6 engines have the necessary pumping and water tank capacity to safely be used for interior attack of involved structures. Interior attack of structures will only occur if the firefighters are appropriately trained in and equipped for structural fire fighting. The park currently follows Bureau of Land Management (BLM) engine inspection and maintenance guidelines in addition to the guidelines of the vehicle manufacturer. Copies of the latest inspection guidelines can be found at the BLM fire website.

The park's primary fire cache is located at the park headquarters Emergency Operations Center (EOC) in Port Angeles. Smaller, initial attack caches are located at ranger stations. The EOC cache is maintained to provide equipment during fire suppression and to replace losses due to other fire management activities; it is not a routine source of supply. The district caches for the most part are six person caches, with handtools, a fire saw, wildland fire pump, and various hoses and fittings. The Fire Management Officer is responsible for maintaining the caches. The wilderness character of the park, rapidly changing weather and potential for intense fire behavior in heavy, west side fuels require that personnel be well equipped. The quantity and quality of the equipment in the caches is designed to fill this requirement. Pre-season and post-season inventories of all caches will be conducted annually by the Engine Bosses. The inventory will be maintained at the fire management office. See Appendix S: Preparedness Inventory. During the pre-season inventory all fire pumps (both engine and portable) shall be inspected and a pre-season check will be done. Engine pumps and chainsaws shall be maintained in a fire ready state at all times. At the end of the season, all equipment will be winterized and re-inventoried.

During incidents, additional equipment and supplies are available through cooperators and the interagency cache system. Requests for equipment from the cache system are made through the Puget Sound Interagency Coordination Center. The U.S. Forest Service caches at Wenatchee, Washington; the Washington DNR cache in Olympia; the Region 6 caches at Redmond and LaGrande, Oregon; and the National Interagency Fire Cache (NIFC) in Boise, Idaho can provide additional logistical support.

d. FIRE WEATHER AND FIRE DANGER

Fire Weather Zones and Fire Weather Stations

There are seven fire weather zones on the Olympic Peninsula. Fire weather zone 649 covers the coastal strip. Zone 650 lies just east of zone 649, and influences a small portion of the inland Exclusion Unit. Zone 652 covers the western interior of the peninsula, including the western half of the Wildland Fire Use and inland Exclusion Units. Zone 661 covers the eastern interior of the peninsula, including the eastern half of the Wildland Fire Use and inland Exclusion Units, as well as the Conditional Units. Zone 653 lies across the north edge and northeast corner of the peninsula. Zone 654 covers the Puget Sound lowlands to the east of the park. Zones 651 and 655 are located south of the park.

State and Federal agencies currently manage between two and five fire weather stations in each weather zone and feed data into the Weather Information Management System (WIMS). The weather observations, and fire danger indices calculated from the observations, are also retrieved via the WIMS computer program. The Remote Automated Weather Station (RAWS) at Hurricane Ridge is the only fire weather station located in the park. It is considered Olympic National Park's primary weather station for the purposes of the FIREPRO analysis, however, information from all of the peninsula's fire weather stations is incorporated into the FMO's daily evaluation of fire danger.

Table 4.2: Fire Weather Stations

Weather Zone	Station	Station Number	Station Type	Agency	Latitude	Longitude	Elevation (Ft.)
649	Quillayute	450120	RAWS	Other Fed.	48.0	124.50	179
649	Hoquiam	450314	RAWS	Other Fed.	47.0	123.90	14
650	Forks	450105	Manual	State	47.96	124.39	303
650	Ellis Mountain	450130	RAWS	State	45.16	124.32	2671

650	Clearwater	450202	Manual	State	47.60	124.30	1063
6661	Cougar	450117	RAWS	USFS	47.92	123.12	2400
652	Humptulips	450312	RAWS	USFS	47.37	123.76	2400
661	Hurricane	450124	RAWS	NPS	47.97	123.63	5280
6661	Jefferson CK	450911	RAWS	USFS	47.55	123.17	2200
652	Toms Creek	450121	RAWS	USFS	48.02	123.92	2400
652	Owl Mt.	450211	RAWS	DNR	47.77	123.97	3398

The following descriptions of several weather stations were adapted from the National Weather Service web site. The web site displays graphs of seasonal trends for each of these stations.

Cougar RAWS is a mid-slope site on Gold Creek in the Dungeness River drainage. During east wind episodes, Cougar experiences moderate wind speeds, lower humidity, and very poor overnight humidity recovery. Located within the Olympic Mountain rain shadow, this site is dry, often exhibiting the highest fire danger of any fire weather station on the Olympic Peninsula. However, Cougar's proximity to the Strait of Juan de Fuca helps moderate fine fuel moisture (and therefore fire danger) by keeping afternoon relative humidity above 30%. This typically occurs when winds are from the northwest to northeast.

Humptulips RAWS is located 30 miles NNE of Hoquiam on the south end of Humptulips Ridge. Summertime weather is heavily influenced by the presence of marine air along the coast with its relatively lower temperatures and higher humidity. However, low humidity along with poor, overnight, humidity recovery are common during periods of strong, offshore flow, or when strong subsidence inversions lower to the ridge top. Located on a southwest aspect, the site is open to marine pushes (especially from the SW) and frontal intrusions. During summer months, even weak fronts produce light to moderate precipitation.

Hurricane Ridge RAWS is located 10 miles south of Port Angeles in the northeast portion of Clallam county. It is the highest-elevation, fire weather site in western Washington with excellent exposure to free-air winds at 5,000 ft msl. Hurricane Ridge often remains warm and dry on days when marine air encircles the lower elevations of the Olympic Mountains. Frontal systems moving inland from the west to northwest will usually bring cloudy, cool, rainy weather to Hurricane Ridge. However, this is less likely to happen when the front moves in from the south or southwest. In late summer and early fall, dry, westerly flow aloft - especially behind a sharp, upper level, short-wave trough - can result in extremely low humidity readings in the single digits.

Jefferson Creek RAWS is located approximately 8.5 miles west of the town of Eldon in NE Mason County. This mid-slope site is situated on the southeast aspect of Jefferson Ridge. Steep, fractured terrain in the area favors diurnal slope and valley winds in the Jefferson Creek drainage. Light winds and good overnight humidity recovery are the rule of thumb. While open to the marine influences of Puget Sound, it also is influenced by frontal intrusions with moderate to heavy rainfall when low level flow ahead of the front is from the east to southeast.

Owl Mt RAWS: This high-elevation RAWS site is located 13 miles west of Mt. Olympus on the Olympic Peninsula, just south of the south fork of the Hoh River. At nearly 3,400 ft msl, Owl Mt. is frequently above the layer of marine air found along the coast during the summer months. During periods of weak, onshore flow Owl Mt. will remain warm and dry, while the Hoh and Queets River valleys to the north and south are filled with stratus and fog. Because of its ridge top location, humidity recovery is not as high as it is in the valleys, however, recovery to 70% or better is common, except during periods of strong, offshore flow or when subsidence inversions lower to the level to the ridge top. During periods of moderate to strong offshore flow, Owl Mt will oftentimes be one of the warmest and driest locations in

Western Washington. Temperatures in the mid to upper 90s with relative humidity in the low to mid teens are normal during strong offshore flow conditions in the late summer and early falls when Canadian high pressure systems slip southeast out of British Columbia. This ridge top site also used to be one of the windier locations in the Olympics, however, several years ago the station was moved to a new site nearby, which unfortunately isn't as exposed to the wind as the original site.

Tom Creek RAWS is located 6 miles southwest of Lake Crescent on the northern portion of the Olympic Peninsula. While moderate to strong east winds are common in the Soleduck River drainage during periods of strong offshore flow, east winds seldom materialize in the Tom Creek drainage. Normal upslope, upvalley winds persist during the day, while light drainage flow with good RH recovery is common at night. Tom Creek is influenced by marine pushes and because of its proximity to the coast will experience moderate to heavy rainfall and gusty winds during frontal passages.

Hurricane RAWS

The Hurricane RAWS is managed cooperatively by Olympic National Park and the Northwest Avalanche Center. At this station, one set of sensors feeds information into two data collection platforms (DCP's). In June 2001, the park's DCP was upgraded from a Handar 540A to a Handar H555B. (The Northwest Avalanche Center uses a Campbell Scientific DCP.) The Hurricane RAWS has all standard fire weather sensors, including a global positioning system unit and a solar radiation sensor. Each day during fire season, between 1330 and 1430 hours, the Puget Sound Interagency Communication Center accesses the Hurricane RAWS observations through WIMS and prepares the data for input to the National Fire Danger Rating System (NFDRS).

The station catalog for the Hurricane RAWS includes the following information:

Station ID: 450124
Nesdis ID: 3280A25A
Station Type: 4:RAWS (SAT NFDRS)
Region: 6
Elevation: 5200 ft.
Local Time Zone: PST
Mnemonic: HURRI
Observing Agency: 3 USDI NPS
Unit Name: WA-OLP
Forecast Zone: 661 (652E)
ID: 7G, Slp: 4, Grs: P, Cli: 3
SI: EC, DC: 6,
SI 90% Val 36; SI 97% Val 45
FIPS; 53 Washington / 009 Clallam
Associated Manual Station: None
Average Annual Precipitation: 74
Station Name: HURRICANE
Latitude: 47 Deg 58 Min 14 Sec (47.97)
Longitude: 123 Deg 29 Deg 54 Sec (123.4980)
Aspect: 0: Flat/None (FL/0)
Owner: OPS$NPS9501
Humidity Code: 2: Relative Humidity (percent)
Rainfall Code: 1: English (IN/MPH/Deg F)
Temperature Code: 1: English
Wind speed Code: 1: English

Forecasts and Observations

The National Weather Service posts fire weather forecasts on their computer web site in the morning at about 0830 hours and in the afternoon at about 1530 hours. Fire weather forecasters also conduct daily fire weather briefings via conference call during the active portion of the fire season. Spot weather forecasts can be requested from the National Weather Service for on-going fires or prescribed burns.

The park's fire office will retrieve fire weather observations, forecasts, indices and situation reports each morning from the various computer sites, and will forward the information to the park's intranet site or electronic bulletin board (if available) or to an electronic mailing list of ranger stations and other interested parties. The fire office or dispatch office will relay weather forecasts and fire danger

information over the radio to personnel who are in the backcountry. Park personnel will be alerted to high fire danger, Fire Weather Watches, and Red Flag Warnings.

National Fire Danger Rating System (NFDRS) Indices

National Fire Danger Rating System (NFDRS) indices are used to gage different aspects of fire danger across each fire weather zone. The FMO evaluates the fire weather and fire danger indices to determine the current level of the Step-Up Staffing Plan (see Chapter IV Section B.2.e.). Large fires in these fire regimes are most likely to occur when there is a combination of dry fine fuels, dry large fuels, and east winds. To monitor the drying of the different size fuels, it is helpful to track both the NFDRS Energy Release Component (ERC) and 1000-Hr Fuel Moisture Content.

The ERC, a wind-independent variable, is the primary NFDRS index used by cooperating agencies surrounding the park. The ERC is a number related to the 24-hr, potential worst case, total energy released per unit area within the flaming front of the fire. It is directly related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. The ERC is open ended or unlimited and, as with other NFDRS components, is relative.

Eligibility for NPS Emergency Preparedness funding is based on the ERC for fuel model G at Hurricane Ridge, and the associated staffing class levels. The staffing class breakpoints were determined using the FIREFAMLY PLUS computer program. The 90th percentile ERC for the fuel model G4P3 at the Hurricane fire weather station is 36, and the 97th percentile is 45. The <u>average</u> 90th percentile ERC for weather stations in zone 649 is 17; in zone 652 is 31, and in zone 661 is 34. In general, when the ERC is below 30, most lightning fires can be easily suppressed if attacked promptly. Even though the ERC fluctuates less rapidly than indexes that are influenced by the wind (such as the Burning Index) the rated fire danger may go from Staffing Class III to V within 24 hours.

The 1000-Hr Fuel Moisture Content represents the modeled moisture content in the dead fuels in the 3 to 8 inch diameter class and the layer of the forest floor about four inches below the surface. Values can range from 1 to 40 percent. In the Olympics, 1000-hr fuel moisture index values at a threshold of 18% or below indicate a potential for larger fires to occur, especially if the ERC is high and there are east winds. If the 1000-hr fuel moisture is low, but the ERC is also low, lightning strikes may linger in the duff, and emerge days later when there are dry winds.

The Burning Index is less useful in this area because it is influenced by wind measurements, which vary rapidly with time, and which vary greatly across the complex terrain.

The following graphs from the National Weather Service web site show the average seasonal trends in the Energy Release Component and 1000-Hour Fuel Moisture for fire weather zones 649, 652 and 661. Recently zones 652 east and 652 west were renamed zone 652 and 661 respectively.

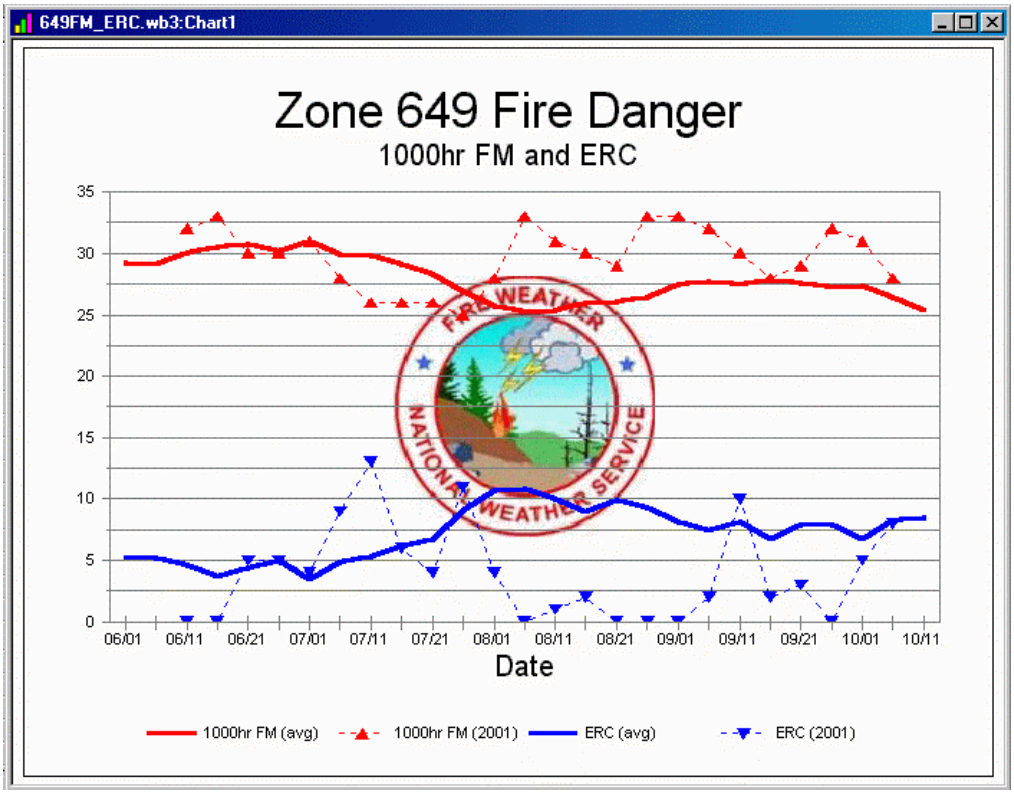

Figure 4.1: Fire Weather Zone 649 Fire Danger

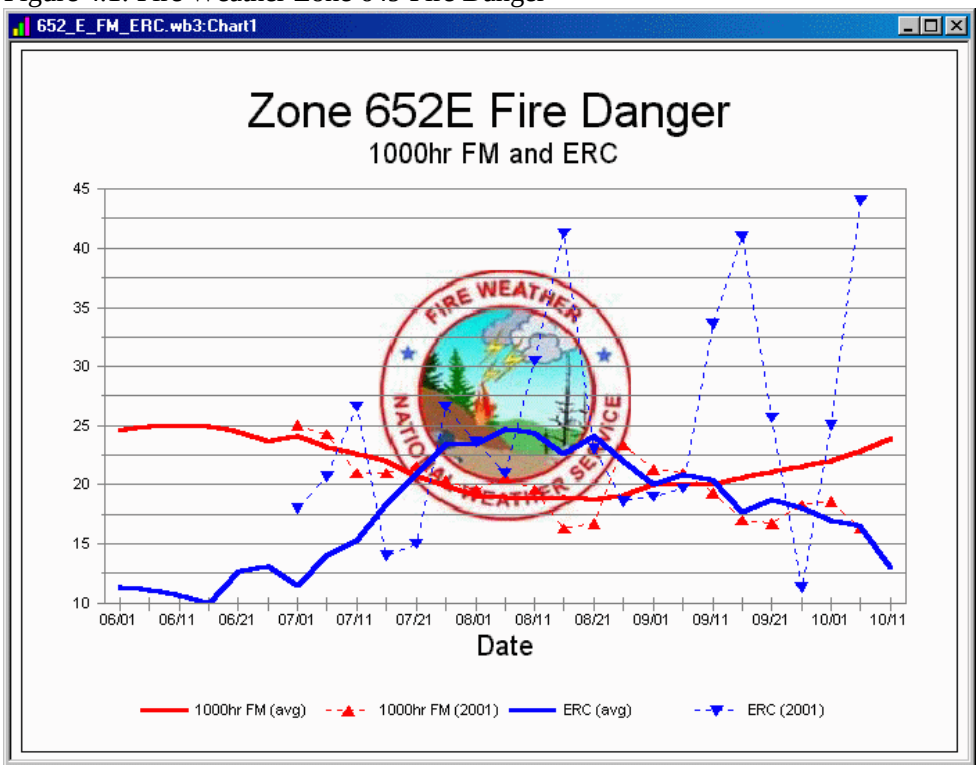

Figure 4.2: Fire Weather Zone 652E (name recently changed to Zone 562) Fire Danger

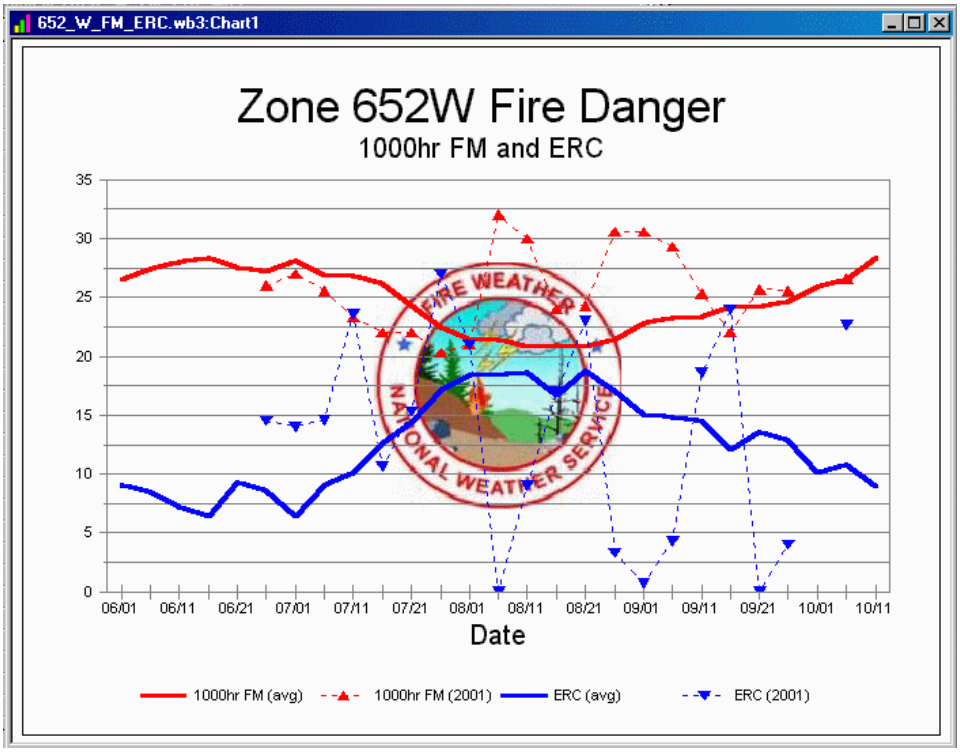

Figure 4.3: Fire Weather Zone 652W (name recently changed to Zone 661) Fire Danger

e. STEP-UP STAFFING PLAN

The Step-up Staffing Plan outlines the management activities that take place as fire danger intensifies. It offers basic guidelines to assist park staff to determine current and anticipated needs as changes in the fire weather occurs. The FMO determines when the specific step-up actions are appropriate and notifies the Chief Ranger and all field areas whenever the Staffing Class (SC) changes. The staffing classes below are utilized only during fire season. They do not apply to winter months, unless an extended winter drought is present which requires staffing for fire. This step up staffing plan also considers the availability of local resources, such as personnel in Olympic National Forest and Washington DNR, Olympic Region.

The primary indexes, which key movement from one Staffing Class (SC) to another, are the Energy Release Component (ERC), the Burning Index (BI), and the 1,000-hour fuel moisture (1,000-hr TLFM). These indexes are based on information gathered from the Hurricane RAWS and surrounding cooperating agency fire weather stations. The BI and ERC are indicators of potential fire spread and intensity. At present, the BI 90th percentile is 46 and the 97th percentile is 55. The ERC 90th percentile is 40 and the 97th percentile is 48. The calculations are based on the Hurricane Ridge RAWS station from the years 1993-2005. This correlates with the time period that Hurricane has been a RAWS station, providing the best and most consistent weather observations for the site. Step-up activities may also be triggered by lightning occurrence or extraordinary park visitation (4th of July, Labor Day), incidents of arson, extended drought, low fuel moistures with high wind events predicted and/or increased fire activity or Industrial Fire Precaution Levels (IFPL) on cooperator's lands adjacent to park boundaries. Although Hurricane is the primary RAWS station that is utilized for determining the step up plan, due to the unique and large nature of the park with such a varied landscape (high elevation, east side being drier, NE corner being within a rain shadow and the west side wetter), other RAWS stations may be utilized to help determine the overall fire danger of the park. The other stations normally used to capture these differences are Cougar and Jefferson.

The park's step up plan chart is also reproduced in Appendix Q (forms).

STEP-UP STAFFING PLAN June 1 to October 15				
Staffing Class (SC)	**Energy Release Component**	**Burning Index**	**Preparedness Actions**	**Minimum Resources Assigned for Daily Operations by Staffing Class**
I-II (Low) • 1000 hour fuels wet (>20% FMC) • Annual and perennial vegetation still green • Large fire growth potential is low.	0-28	0-36	• Fire dispatch and fire personnel on normal tour of duty. • Fire weather stations activated. • All fire equipment in state of readiness. • Open burning requires written burn permits issued by the Fire Management Office. • Notify PSICC of fire danger rating and available resources on daily status report. • Fire Weather broadcast by DNR Olympic Dispatch daily via DNR frequencies.	• Duty Officer (minimum ICT4) identified and available by phone if not on duty. • One NPS engine (Type 6 or higher) on normal duty with minimum ENOP/ICT5 plus one firefighter.
III (Moderate) • 1000 hour fuels wet (16-20% FMC) • Annual and perennial vegetation curing • Large fire growth potential is low to moderate.	29-39	37-45	• Fire dispatch and fire personnel on seven day coverage. • Tour of duty for initial attack personnel may be changed to cover peak burning period, 1000-1800. • Forecasted trigger events (LAL 3+, East winds, dry/unstable air mass (Haines 6), holiday weekends move to SC IV. • Fire Weather broadcast by DNR Olympic Dispatch daily via DNR frequencies. • IF LAL is between 3-6, fixed wing detection recon may be performed in conjunction with cooperating agencies, if ALDS system indicates lightning activity.	• Duty Officer (minimum ICT4) assigned for seven day coverage, by phone as necessary. • ICT3 identified as available in the Park or with a cooperating agency on the Peninsula. May be filled on an interagency basis. • One NPS engine (Type 6 or higher) on normal duty with minimum ENOP/ICT5 plus one firefighter. Total of two additional engines available on the Peninsula (may be any combination of T3,T4, T5 or T6 and may be either NPS, DNR, USFS).

				• One ICT5 plus 1 firefighter available for IA.
IV (High) • 1000 hour fuels wet (14-16% FMC) • Annual and perennial vegetation mostly cured • Large fire growth potential is moderate to high.	40-47	46-54	• All SC-3 actions with further constraints below. • Notify DNR Olympic dispatch and Olympic National Forest dispatch of fire danger rating • Check daily availability of local resources on the peninsula and regional fire suppression resources, including aircraft; provide IC types with available resource information. • Fire information and fire danger status disseminated to park staff via park dispatch morning reports. • Park information stations and visitor information programs distribute fire prevention messages to park visitors. • Tour of duty for initial attack personnel will be changed to cover peak burning period, 09:30-18:00. • Availability of collateral duty firefighters will be sought. • Fire restrictions will be discussed for backcountry campfires and implemented as necessary. • All campfires in the backcountry will be prohibited if SCIV is predicted for seven days or more; any burn permits will be cancelled. • Forecasted trigger events (LAL 3+, East winds, dry/unstable air mass (Haines 6)	• Duty Officer (minimum ICT4) assigned for seven day coverage, by phone as necessary. • ICT3 identified as available in the Park or with a cooperating agency on the Peninsula. May be filled on an interagency basis. If none available, order ICT3 on severity. • One additional ICT4 available on weekends. May be filled on an interagency basis. • One NPS engine (Type 6 or higher) on normal duty with minimum ENOP/ICT5 plus one firefighter. Total of three additional engines should be available on the Peninsula (may be any combination of T3,T4, T5 or T6 and may be either NPS, DNR, USFS). If not available due to ongoing incidents, consider ordering severity engines to fill void. • One ICT5 plus 3 firefighters available for IA.

			move to SC V.	
V (Very High) • 1000 hour fuels wet (<14% FMC). • Annual and perennial vegetation cured. • Large fire growth potential is high.	48+	55+	• All SC-4 actions with further constraints below. • Cancel lieu days and leave for fire staff; follow work rest guidelines. • Available collateral duty firefighters will be on call for in park dispatch • Extend duty hours of red carded personnel if trigger events are forecast. • Fire restrictions for backcountry campfires will be implemented. • Fire restrictions will be considered for frontcountry campgrounds. Initiate restrictions if Level V is predicted to last longer than 5 days. • Consider automatic dispatch of helicopter to all new backcountry wildland fires. • Existing wildland fires used for resources benefits may be suppressed, any new wildland fire used for resource benefit require regional office approval. • Closure of certain park areas to public use and entry will be considered • If Level V predicted to last longer than 5 consecutive days, consider ordering additional suppression resources for staging off of severity funding. Coordinate with cooperating agencies.	• Duty Officer (ICT4) assigned on duty for seven day coverage, may be filled on an interagency basis. If Level V predicted to last longer than five consecutive days, Duty Officer will be a qualified ICT3. If none available, order ICT3 on severity. • One ICT4 available for seven day coverage. May be filled on an interagency basis. • Two NPS engines (Type 6 or higher) on normal duty with minimum ENOP/ICT5 plus one firefighter. Total of three additional engines should be available on the Peninsula (may be any combination of T3,T4, T5 or T6 and may be either NPS, DNR, USFS). If not available due to ongoing incidents, consider ordering severity engines to fill void. • One ICT5 plus 3 firefighters available for IA • Four collateral duty firefighters will be identified by name for in park fire dispatch.

B.3. PRE-ATTACK PLAN

See Appendix V: Pre-Attack and Mobilization Plan

B.4. INITIAL ATTACK

Initial attack is an aggressive suppression action consistent with firefighter and public safety and values to be protected. This strategy is applied when a fire occurs in the Exclusion Unit, or as the result of WFIP Stage I analysis under the appropriate management response process in the Conditional and Wildland Fire Use Units.

a. INFORMATION SOURCES

Information regarding values-to-be-protected and fire potential are used to set initial attack priorities. Sources of this information include:
- GIS themes: vegetation, elevation, roads, trails, waterways, structures, cultural and historic sites, etc;
- Printed topographic maps and road maps;
- Aerial photos;
- Weather forecasts and fire danger indices;
- Fire behavior computer programs
- Park resource specialists;
- Aerial and on-site observations of fuels, weather, topography, and fire behavior.

b. CRITERIA FOR THE APPROPRIATE INITIAL ATTACK RESPONSE

The intensity of the initial attack response will be based on an evaluation of the conditions surrounding the fire, and the probable effects of the response. The choice of initial attack strategies should take into account the following factors:

- **Public safety**. Human safety must always be given the highest priority.
- **Firefighter safety** must include consideration of: accessibility; terrain hazards; fire behavior; location of escape routes and safety zones; communication limitations; capabilities of available resources.
- **Proximity of values-to-be-protected**, including: private property and neighboring lands; structures and other developments; rare, sensitive, threatened and endangered species; critical habitat; research natural areas; soils; wetlands; riparian zones; water quality; fisheries concerns, air quality; visibility (especially from scenic viewpoints); historic and cultural resources; research sites; and recreational use of the area.
- **Fire management unit**, with a higher priority, and more aggressive response normally given to fires in the Exclusion Unit.
- **Wilderness considerations**, including minimum requirement and minimum tool.
- **Potential impacts of suppression activities** on natural and cultural resources.
- **Current and expected fire behavior / fire growth,** based on fuels, weather and topography.
- **Location of natural containment features,** such as scree slopes and waterways.
- **Availability of firefighting resources,** and competing demands for resources.

- **Costs** of implementing alternative strategies.

c. CONFINEMENT AS AN INITIAL ATTACK SUPPRESSION STRATEGY

A confinement strategy may be implemented as the initial attack action as long as it is not used to meet resource objectives. Confinement is selected in lieu of wildland fire use to maximize firefighter safety, minimize suppression costs, minimize cost + loss in low value and commodity resource areas, and to maximize availability of critical suppression and management resources during periods of high fire danger associated with fire in highly valued resource areas.

Confinement can also be a strategic selection through the WFSA process when the fire is expected to exceed initial attack capability or planned management capability. When confinement is selected as the initial action, the same management process applies as for wildland fire use decisions. A long-term implementation plan is needed to guide the implementation of the confinement strategy. The WFIP prepared in stages, meets this requirement.

d. TYPICAL FIRE RESPONSE TIMES

Summer
Engine: 30 minutes to 2 1/2 hours for fires near roadways
Firefighters: 30 minutes to 24 hours, depending on location of the fire.
Helicopter: If not already deployed on fires outside the area, response time is usually 2 hours to 6 hours.
Fixed Wing: If not already committed to projects, response time is usually 2 hours to 6 hours.

Fall/Winter/Spring
Response time for all resources varies from 2 hours to 48 hours.

e. RESTRICTIONS AND SPECIAL CONCERNS
Endangered Species Concerns

In order to reduce the mortality of juvenile murrelets in Conservation Zone 1 during the early breeding season, any wildland fire use that exceeds 10 acres of stand replacement patch size and occurs within murrelet habitat prior to August 6, will be converted to a wildland fire.

All Areas

Olympic National Park Minimum Impact Tactics (Appendix F) and other environmental mitigation measures will be used park-wide for all fire management operations. Recommendations include, but are not limited to the following:

Equipment Use:

Minimize or avoid stream course disturbance, sedimentation, and actions that will result in increased water temperature.

Maintain minimum no-touch buffer within established area of fish-bearing streams. This could include up to 250-feet within the area of these streams and is dependent on site specific prescriptions currently being developed.

Dozers/Tractors are not historically used in fire suppression in Olympic National Park. If an emergency circumstance required an exception (only with the Superintendent's approval), the following rehabilitation measures would be recommended:

a. Water bars should be constructed at a 30 to 45 degree angle. Height of water bars should not exceed 18 inches. Space 50 feet apart on slopes greater than 30 percent and 100 feet apart on slopes between 10 and 30 percent. The downslope side of the waterbar needs to be opened and of adequate length to allow free flow of water off the tractor line.

b. Breakup and pull all berms, tractor piles and windrows. Lop and scatter slash on disturbed areas to achieve 50 percent ground cover on disturbed sites.

Aircraft Use:

Consider judicious use of helicopters – consider long lining instead of helispot construction.

If helicopters are involved, use natural openings as much as possible for helispots; minimize cutting only to allow safe operations.

Avoid construction of landing areas in high visitor use areas, if at all possible.

Rehabilitate all helispots once the fire operations are complete.

Chemical Retardant and Foam:

Wherever possible, avoid using chemicals when there is a potential for contamination of waterways (based on proximity, wind direction, wind speed, size and frequency of loads, etc.) Avoid use of retardant or foam within 300 feet of streams or within designated critical habitat. Use of retardant should also be avoided in areas with oligotrophic lakes, bogs, or swamps as effects on aquatic biota may be prolonged. Consult with resource advisors.

Consider use of helicopter bucket drops and water/foam before calling for air tanker/retardant.

Do not pump directly from streams if chemical products are going to be injected into the pump or pumping system. If chemicals are needed, use a fold-a-tank from which to pump water.

If possible, do not dip helicopter buckets from streams where juvenile or adult salmon may be present. ONP biologists could provide a list of these waterways. (Firefighter and public safety will always take precedence, and if helicopter drops are needed, they will be utilized.)

If possible, dipping of helicopter buckets will occur only after chemical injection system (storage containers) have been removed or disconnected from the bucket or helicopter.

Keep refueling, fuel storage, and fuel trucks outside designated critical habitat, or utilize spill pads and/or containment units.

Use spill pads under portable pumps and fuel cans/fuel lines connected to pumps.

Wilderness

All management decisions affecting wilderness must be consistent with a minimum requirement concept. The purpose of the "minimum requirement concept" is to reduce the effects of management actions on wilderness character and values. The minimum requirement process provides a method for developing, evaluating, and selecting the actions that provide the least intrusion on wilderness character and values. The concept is to be applied to all management actions, programs and activities that have potential to affect wilderness and potential wilderness additions. The minimum requirement process will be applied at Olympic through use of the "Minimum Requirement Worksheet. (See Appendix E. Minimum Requirement Process.) The Minimum Requirement Process will be used prior to commencement of each individual site prescription in the wilderness and the associated use of tools for those individual sites. This document also helps guide the response to suppression of fires in the wilderness and the minimum tool for these operations. Use of the Minimum Requirement Process is required for post-fire rehabilitation actions as well as suppression activities.

Research Natural Areas

Four Research Natural Areas (RNA) are designated in the park. RNA's preserve discrete plant communities and other natural features for scientific and educational purposes. All four RNA's in Olympic are within the Exclusion Unit, but it is important to consider that fire itself may cause less damage to these basically unmodified sites than such fire suppression activities as fireline construction, tree felling and aerial retardant drops. Whenever a fire approaches or threatens an RNA, a resource advisor will be assigned and on site with the firefighters.

Human-caused fires in or threatening RNA's will be suppressed as quickly as possible in accordance with the management objectives of this plan regarding the Exclusion Unit If, however, suppression can be accomplished in a timely manner without control activities within the RNA, and, if in the end less overall damage to the site ecology of the RNA will result, modified suppression is preferred.

Lightning fires in or threatening RNA's will be suppressed as quickly as possible, but every effort will be made to avoid control activities within the RNA. The effects of natural fire are not incompatible with RNA management goals and it would be more prudent to allow the fire to pass through the RNA than direct suppression efforts within it.

In all cases, post-fire rehabilitation within RNA's is not appropriate and will not be performed.

The four RNA's currently designated are:
- Hades Creek-560 acres Bogachiel River drainage
- Twin Creek-100 acres Hoh River drainage
- Jackson Creek-160 acres Hoh River drainage
- Higley Creek-480 acres Quinault River drainage

Elk Exclosures

Elk exclosures are fenced study areas designed to exclude ungulates, providing opportunities for biologists to compare browsed and unbrowsed ranges. The largest of the five exclosures in the park is slightly over one acre in size. All of the current exclosures are within the Exclusion Unit. Construction of additional exclosures is not anticipated. To maintain scientific validity, exclosures and the surrounding area must be managed as a unit. Protecting only the exclosure from fire, for example, makes no sense if the surrounding range, which serves as the control, is allowed to burn. For the purposes of this plan, exclosure complex

defines the actual fenced area and its immediate surrounding area. A one-acre exclosure is the core of a six to eight-acre exclosure complex.

Human-caused fires in or threatening an exclosure complex will be suppressed. As with RNA's, control activities within the exclosure complex should be avoided where reasonable and prudent. Natural fire is not incompatible with exclosure management goals. Unwanted fires may require suppression actions to be taken, but control activities will not be permitted within the complex itself. Lightning fires within the exclosure complex will be allowed to burn and will be suppressed when necessary to prevent adverse fire effects on other values-at-risk to prevent fire spread outside the park.

Rehabilitation of exclosures must be performed immediately after the fire is extinguished but is limited to repair or replacement of the fence structure. No vegetative manipulation is appropriate.

The five exclosures in the park are:
- Kloochman Trail (Big Fir) - Queets River drainage
- South Fork Hoh - (2) South Fork Hoh River drainage
- Mosquito Creek - Bogachiel River drainage
- Hughes Creek - Elwha River drainage

f. LOCAL ISSUES

Indian Nations and Tribes will be consulted regarding sensitive cultural resources when fires larger than 10 acres occur in the tribes' traditional territories. The Park's Cultural Resource Division will be responsible for serving as liaison on this issue.

B.5. EXTENDED ATTACK AND LARGE FIRE SUPPRESSION

Extended attack occurs when a fire has not been contained or controlled by the initial attack forces and continues, either until transition to a higher level incident management team is completed, or until the fire has been contained/controlled.

a. EXTENDED ATTACK NEEDS

Extended attack action requires a Wildland Fire Situation Analysis (WFSA) to guide the re-evaluation of suppression strategies. The WFSA is a decision process that employs a systematic and reasonable approach to determine the most appropriate management strategy for a particular situation. Reasonable management alternatives are identified, analyzed and evaluated, and are consistent with the expected probability of success/consequences of failure. The superintendent shall approve the WFSA and any revisions. Evaluation criteria includes firefighter safety, anticipated costs, resource impacts, and environmental, social, and political considerations. The evaluation of alternatives must clearly identify the point at which the failure of the alternative is imminent. This becomes the triggering mechanism for re-evaluation of the WFSA.

b. IMPLEMENTATION PLAN REQUIREMENTS – WFSA DEVELOPMENT

Components of a WFSA include:
- WFSA initiation section (specific fire information and date/time initiated).
- WFSA completion/final review (information concerning when the selected alternative was achieved or when a new WFSA was prepared. This provides closure to this particular WFSA. Also includes agency administrator signature).
- Wildland Fire Situation Analysis (WFSA Information Page).
- Objectives and Constraints

- Alternatives
- Evaluation of Alternatives
- Analysis Summary
- Decision
- Daily Review
- Guide for Assessing Fire Complexity.

c. COMPLEXITY DECISION PROCESS FROM INITIAL ATTACK TO EXTENDED ATTACK

The fire complexity analysis is prepared concurrently with the preparation of a new or revised Wildland Fire Situation Analysis. It is a checklist intended to guide the superintendent in determining incident organizational needs and determining when transition from extended attack to a higher qualified incident management team is necessary. It is prepared by the FMO in consultation with other park staff. Before additional resources are ordered, an analysis must be completed and becomes part of the fire record.

The complexity or predicted complexity of a fire situation is prepared using the guide in NPS 18 Chapter 9 (Reproduced in Appendix Q of this plan). Thirty-five elements are evaluated in the complexity analysis. The elements are grouped into eight categories: Fire Behavior, Resources Committed, Park Resources Threatened, Safety, Jurisdiction, External Influences, Change in Strategy, and Existing Overhead. The complexity analysis assists in the determination of the appropriate management level for an incident.

d. DELEGATION OF AUTHORITY

The transfer of authority for suppression actions on a fire is done through execution of a written limited delegation of authority from the superintendent to the incident commander. This procedure facilitates the transition between incident management levels. An incident management team may assume authority to manage a fire only after receiving a signed limited delegation of authority from the superintendent.

See Appendix O, Sample Delegations of Authority.

B.6. EXCEEDING WFIP – SELECTING A NEW STRATEGY

If an ongoing wildland fire use action does not meet desired objectives, exceeds the WFIP, or if external concerns (such as multiple new starts in the area) make it inadvisable to continue the action, the fire will be considered an unwanted fire and a Wildland Fire Situation Analysis (WFSA) will be prepared to guide a fire suppression action. The WFSA is also prepared for a fire that has been receiving a suppression-oriented response if initial attack fails. The WFSA is a decision-making process in which the agency administrator or representative describes the situation, establishes objectives and constraints for the management of the fire, compares multiple strategic wildland fire management alternatives, evaluates the expected effects of the alternatives, selects the preferred alternative, and documents the decision.

B.7. MINIMUM REQUIREMENT PROCESS AND MINIMUM IMPACT TACTICS

All management decisions affecting wilderness must be consistent with a minimum requirement concept The purpose of the "minimum requirement concept" is to reduce the effects of management on wilderness character and values. The minimum requirement process provides a method for developing, evaluating, and selecting the actions that provide the least intrusion on wilderness character and values. The concept is to be applied to all management actions, programs and activities that have potential to affect wilderness and potential wilderness additions. The minimum requirement process will be applied at Olympic through use of the "Minimum Requirement Worksheet". (See Appendix E. Minimum Requirement Process.) The Minimum Requirement Process will be used prior to commencement of each individual

site prescription in the wilderness and the associated use of tools for those individual sites. This document also helps guide the response to suppression of fires in the wilderness and the minimum tool for these operations. Use of the Minimum Requirement Process is required for post-fire rehabilitation actions as well as suppression activities.

In addition, Minimum Impact Tactics are required by NPS policy for all fire management activities on NPS lands. These guidelines address considerations for Agency Administrators, Incident Management Teams and Firefighters. They include measures to minimize vegetation, wildlife and soil disturbance, and protect water quality. Appendix F contains guidelines for Minimum Impact Tactics modified for Olympic National Park.. ONP modifications include additional precautions for protecting water quality, riparian zones, and critical habitat.

B.8. SHORT AND LONG TERM REHABILITATION GUIDELINES AND PROCEDURES

See Chapter IV Section F. Emergency Rehabilitation and Restoration.

B.9. RECORDS AND REPORTS

The following is a standard outline of contents for a permanent project record for a suppression-oriented appropriate management response. The Fire Program Assistant is responsible for maintaining the hard copy files. The files are kept in the Fire Management Office. A separate file is kept for each incident.

	Item	Who is responsible, Where documents are kept.
a.	DI-1202 Individual Fire Report and Narrative.	Prepared by the IC or a member of the fire management staff, and submitted to the FMO for approval. The Fire Program Assistant enters the DI-1202 into WFMI within seven days of being declared out and files a hard copy in the incident files in the fire management office.
b.	Approved Wildland Fire Situation Analysis for each fire that exceeds initial attack. Include all amendments and revisions.	Prepared by the FMO or designee. The Fire Program Assistant stores them in the incident files.
c.	Revalidation and certification documents (if applicable).	These are signed by the Superintendent or designee. The Fire Program Assistant files them with the WFSA in the incident files.
d.	Daily weather forecasts and spot weather forecasts.	The Fire Program Assistant is responsible for printing the daily weather forecasts and any spot forecasts that are requested by the Incident Commander or FMO during an incident. The Fire Program Assistant ensures that the fire weather is distributed to outlying areas, and stores the forecasts in the incident files.
e	Monitoring reports, including (if applicable) a summary of all monitoring activities, summaries of findings, and photopoints. (level 1 and 2 monitoring)	This is completed by the Fire Monitor. The Fire Program Assistant stores the monitoring information in the incident files.
f	Funding codes	The Fire Program Assistant maintains a log of all suppression accounts, and, requests the Puget Sound Interagency Communication center open a new fire code (funding code) for each fire or groups of fires. The FPA will then ask the park's budget office to establish a new account in the

		accounting system.
g	Cost accounting	The Fire Program Assistant files all timesheets and obligating documents for each incident in the incident files.
h.	Total cost summary	This is prepared by the FMO or a member of the fire management staff based on information in obligating documents and AFS3 printouts.
i.	Project maps. Cumulative fire map showing acreage increase by day. Also include maps of helicopter flights documented with Global Positioning System equipment, when possible.	The Fire Program Assistant stores hard copy maps in the incident files. GPS/GIS data is submitted to the park's GIS office for inclusion in the GIS database. All fires greater than 10 acres are to be permanently mapped and archived on the parks fire history layer. Fires larger than 100 acres will be also be uploaded into the regional data base.
j.	Overhead and Crew Evaluations (as applicable)	The Incident Commander is responsible for completing overhead and crew evaluations. The Fire Program Assistant stores these in the incident files, with a copy in individual's folders in the fire management office.
k.	Experience Records	The Fire Program Assistant is responsible for entering fire experience into the IQCS.
l.	Other information, as appropriate, for the situation such as location of helispots.	This information will be kept in the incident files, and in GIS records as appropriate.

C. WILDLAND FIRE USE

Wildland fire use must be based soundly on management objectives (public and firefighter safety, cultural and natural resource objectives, etc.) and may include the full range of fire management strategies on a fire's entire perimeter.

C.1. WILDLAND FIRE USE: OBJECTIVES AND MANAGEMENT CONSIDERATIONS

One of the primary goals of the fire management plan is to "Restore and maintain natural fire regimes to the maximum extent practicable so natural ecosystems can operate essentially unimpaired by human interference." (See Chapter III Section A.) This goal will be accomplished primarily through a program of wildland fire use.

a. OBJECTIVES

- To the extent possible within the constraints detailed in this plan, maintain the role of fire within the natural range of variability for the ecosystem. Fire intensity may range from low-to-moderate intensity fires that burn through the understory, to high-intensity, stand-replacing fires. Fire size may range from less than an acre to several hundred acres.

- Limit wildland fire use (in the Wildland Fire Use and Conditional Unit combined) to 200 acres (81 ha) per year in areas where there is suitable habitat for Northern Spotted Owls or Marbled Murrelets, with an allowance for an additional 600 acres (243 ha) to be managed as wildland fire use in one year out of five. In addition, limit wildland fire use to 500 acres (202 ha) per year in areas outside of suitable habitat. Wildland Fire Use that has potential to exceed these acreage figures, but meets all other wildland fire use criteria, will be considered candidates for wildland fire use management only with additional environmental analysis and consultation.

- Contain at least 95% of unwanted fires (human-caused fires and fires which do not meet criteria for wildland fire use) at less than 10 acres in size.

- Ensure that wildland fires are contained within the Conditional and Wildland Fire Use Unit, unless agreements have been established to allow joint management of wildland fire across agency boundaries (Conditional Unit only). Take holding or suppression action on wildland fires that have the potential to threaten private lands or neighboring public lands.

- Reduce hazard accumulations of fuels around historic and administrative structures to enhance protection of these structures from wildland fire.

b. MANAGEMENT CONSIDERATIONS

Safety and Resource Protection

- SAFETY: Provide for firefighter and public safety as the first priority in every fire management activity. Ensure that the 10 Standard Fire Orders and LCES are followed, and the 18 Watch Out Situations are mitigated. Emphasize safety in all aviation operations, felling operations and burnout operations. Ensure compliance with work/rest ratios. Disengage suppression activities immediately if strategies and tactics cannot be implemented safely.

- DEVELOPMENTS: Protect major structures and developments from fire, with the stipulation that management actions must keep safety as the number one priority. Management actions must also take into consideration wilderness values, natural and cultural resources, and cost-effectiveness. Suppression activities may be modified or limited to protect ecosystem processes and wilderness values.

- WILDERNESS: Ensure that wilderness resources and wilderness values are considered when developing implementation plans. Use the park's Minimum Requirement Process to help guide the response to wildland fires and the choice of minimum tool in the wilderness. Utilize Olympic National Park's Minimum Impact Tactics and other environmental mitigation measures in all fire management operations.

- NATURAL AND CULTURAL RESOURCES: Manage each fire to minimize environmental damage. To the extent possible, protect historical and cultural resources, rare, sensitive, threatened and endangered species, wetlands, riparian/shoreline areas and sensitive habitats. For all fires known to be near special resources such as archeological sites or rare plant populations, and all fires greater than 10 acres in size, consult with natural and cultural resource management staff to determine if resource advisors should be assigned. Similar precautions should be taken if fire camps, staging areas, or helispots are located near known special resources.

- AIR QUALITY: Manage prescribed and wildland fires in concert with federal, state and local air quality regulations. Ensure that air quality thresholds of NAAQA and visibility requirements are considered in developing implementation plans.

- MONITORING: Monitor all wildland fire use actions:
  - To ensure protection of human life, property, and natural/cultural resources;
  - To assist with contingency planning;
  - To gain information about fire behavior and fire effects; and,
  - To monitor smoke emissions for identification of health concerns

Related Considerations

- HUMAN RESOURCES: Manage human resources in a manner that promotes mutual respect and is free of harassment. Provide training opportunities on incidents when feasible.

- COLLABORATION: Maintain a team approach to fire management at Olympic National Park, where all divisions within the park are represented and assist in the management of fire within the park. Maintain liaison and collaboration with cooperating agencies in all fire management activities, including planning, training, prevention, detection, suppression and research. Establish memoranda of understanding or interagency agreements to integrate fire management activities across agency boundaries.

- PUBLIC INFORMATION: Provide timely and accurate information to visitors, neighbors and employees regarding: fire ecology, the fire management program, fire prevention, fire danger, restrictions and closures. Public information should be conveyed in a manner that avoids unprofessional or emotionally-charged terms. In accordance with NPS policy, information about wildland fires used for resource benefits will not be mixed with information on the status of wildland fire suppression.

- PUBLIC USE: Manage fire operations to minimize disruption to visitor access and local public use.

- COSTS AND LOSSES: Manage fire cost-effectively for the values at risk. Maximize efforts to utilize local resources and vendors. Manage equipment and supplies to ensure losses are within acceptable fire loss/use rates.

C.2. DECISION MAKING

Decision criteria are used to evaluate candidate wildland fires (WFIP Stage I), and to periodically re-assess wildland fire use actions. A supplemental decision chart, shown below in Chapter IV Section C.4.c. has been developed with specific decision criteria for Olympic National Park. The decision chart augments the standard forms used in WFIP Stage I.

The following information, based on fire research at Olympic and the experience gained from previous fires, will be used during the evaluation of decision elements and the development of the appropriate management response.

Time of the Year: Early or Late in the Fire Season

Most human-caused fires occur between mid-June and mid-September. Thunderstorms may occur at any time of the year, but rarely cause fires except in July and August. East wind fire weather is most common in the late summer and early fall.

Fire starts occurring early in a normal fire season may be suppressed to limit the potential for an extended fire management action. As seasonal drying of fuels takes place, prolonged fire events can lead to an unmanageable incident from the standpoint of fire size, intensity, smoke production and impacts on scenic views. The continual demands on management personnel and available funding may become unacceptable. Early season fires of long duration may have a greater impact on suitable endangered species habitat or causing smoke impacts on juvenile spotted owls and murrelets that have not fledged their nests yet.

Fires late in the season usually do not require intensive suppression. Progressively shorter daylight hours, cooler maximum temperatures, increased humidity recovery at night and a greater chance of precipitation

significantly increase fuel moisture and reduce rate of spread and ultimate fire size. These late season fires are also normally outside of or at the tail end of the breeding season, so may have less effect on individuals of the species.

Location: Proximity of fire to zone or park boundary, structures, administrative facilities, other developments or species of concern.

Fires which might enter the Exclusion Unit from the Conditional or Wildland Fire Use Units require holding or suppression action. Holding actions on specific flanks may be necessary to limit spread and/or to protect structures, administrative facilities, cultural resource sites and other developments.

Actions on fires in remote locations, without potential to enter the Exclusion Unit or to escape the park, can usually be limited to confinement and observation.

Although fire is a natural part of the environment, and endangered species or species of concern have evolved with fire, consideration as to the fires location to suitable habitat should be considered by the management team.

Topography: Elevation, presence of natural barriers to fire spread, percent slope, aspect and position on slope.

Above 5,000 feet, the discontinuous nature of available fuels normally limits fire spread. Fires on steep southeast, south and southwest-facing slopes have the highest potential for spread. Ridges, major rivers, side drainages, avalanche chutes and riparian zones can be effective barriers to spread.

Fuels: Characteristics of the fuels available to the fire; relative fuel moisture.

The majority of lightning fires in Olympic start in subalpine areas in fuels of NFFL Model 8. These fuels typically produce fires of low intensity and spread rates. Below the subalpine zone, fuel loading in the park is as heavy as any forested area in the United States. During periods of high fire danger, these heavy fuels of NFFL Model 10 will burn readily and with tremendous energy. Fires under these conditions will have long residence times and be very resistant to control. Large fires are more likely to occur when the 1,000-hour fuel moisture is 18% or less. There have been situations where the 1000-hour fuel moistures have been as low as 14, yet the fire did not spread, depending on the position of the fire on the fire on the slope and/or aspect.

Weather : Current and predicted fire weather, number of days since significant precipitation and prediction of east winds.

The largest fires would be expected to occur following several years of below normal rainfall. On a short-term basis, below normal precipitation in the winter and spring months leading into the fire season coupled with three weeks or more since significant precipitation (0.25 inches or more), and the presence of east winds historically results in the highest incidence of large fires.

Even when precipitation is at near-normal levels, ground strikes from lightning storms will inevitably ignite fine fuels if a period of approximately four weeks since significant precipitation has elapsed prior to the lightning activity. Following ignition, significant or prolonged fire events should be expected if more than 14 consecutive days elapse without significant precipitation, especially if accompanied by east winds.

East winds on the Olympic Peninsula generally form when high pressure is blocked by the Cascade Mountains and stalls over the Puget Sound Basin. Lower pressure off the Washington coast results in an

unequal pressure gradient, which reverses the air mass to a drying, offshore flow. Any fire burning during a period of east wind is potentially serious.

Narrow valleys and canyons often experience strong, turbulent diurnal winds exceeding 20 miles per hour during summer afternoons. Such wind patterns are very localized. Lake Cushman near Staircase, the Dosewallips River valley, the Elwha River valley in the vicinity of Lake Mills and the Soleduck River valley near Lake Crescent are examples of such areas.

Morning fog and low clouds frequently form in the summer near marine areas around the perimeter of the Olympic Peninsula. This pattern may persist for many consecutive days. A thermal inversion may create higher daytime temperatures and lower relative humidity at higher elevations of the park resulting in very high fire danger. Large fires burning beneath these inversions may produce severe smoke conditions. The fog also effectively curtails aircraft operations until mid-afternoon or when the fog lifts.

Fire Weather Stations In and Around Olympic National Park

Most of the park is in fire weather zones 649 (the coast), and 652 and 661 (the interior of the peninsula). Because there is a strong west-east gradient in precipitation across zones 652 and 661. For a more detailed discussion of Fire Weather Zones and Fire Weather Stations see Chapter IV Section C.2.d.

Table 4.2 Fire Weather Stations

Weather Zone	Station	Station Number	Station Type	Agency	Latitude	Longitude	Elevation (Ft.)
649	Quillayute	450120	RAWS	Other Fed.	48.0	124.50	179
649	Hoquiam	450314	RAWS	Other Fed.	47.0	123.90	14
661	Cougar	450117	RAWS	USFS	47.92	123.12	2400
652	Humptulips	450312	RAWS	USFS	47.37	123.76	2400
661	Hurricane	450124	RAWS	NPS	47.97	123.63	5280
661	Jefferson	450911	RAWS	USFS	47.55	123.17	2200
652	Tom Creek	450121	RAWS	USFS	48.02	123.92	2400
652	Owl Mt.	450211	RAWS	DNR	47.77	123.97	3398

Fire Danger: Current and Predicted

Large fires in these fire regimes are most likely to occur when there is a combination of dry fine fuels, dry large fuels, and east winds. To monitor the drying of the different size fuels, it is helpful to track both the NFDRS Energy Release Component (ERC) and 1000-Hr Fuel Moisture Content.

The ERC, a wind-independent variable, is the primary NFDRS index used by cooperating agencies surrounding the park. The 90^{th} percentile ERC for the fuel model G4P3 at the Hurricane fire weather station is 36, and the 97^{th} percentile is 45. The average 90^{th} percentile ERC for weather stations in zone 649 is 17; in zone 652 is 31, and in zone 661 is 34. The Staffing Class level is based on the ERC. Even though the ERC fluctuates less rapidly than indexes that are influenced by the wind (such as the Burning Index) the rated fire danger may go from Staffing Class III to V within 24 hours.

The 1000-Hr Fuel Moisture Content represents the modeled moisture content in the dead fuels in the 3 to 8 inch diameter class and the layer of the forest floor about four inches below the surface. Values can range from 1 to 40 percent. 1000-Hr Fuel Moisture index values at a threshold of 18% or below indicate a potential

for larger fires to occur, especially if the ERC is high and there are east winds. If the 1000-hr Fuel Moisture is low, but the ERC is also low, lightning strikes may linger in the duff, and emerge days later when there are dry winds.

The Burning Index is less useful in this area because it is influenced by wind measurements, which vary rapidly with time, and which vary greatly across the complex terrain.

See Chapter IV Section C.2.d. for graphs of seasonal trends in fire weather indices.

Fire Behavior. Observed fire behavior: smoldering, creeping, running, crowning or spotting, flame length. Predicted fire behavior: calculated rate of spread, flame length, fireline intensity, and probability of ignition.

The majority of lightning fires in Olympic are ignited by wet lightning storms and lay down after the first burning period. If not extinguished by rain, these fires can smolder undetected, burning deeply into the duff layer. On succeeding days, such fires may be extremely difficult to detect from patrol aircraft and have the potential to become "sleepers." Warming weather conditions, especially in conjunction with east winds can bring these latent fires to life, sometimes up to three weeks or longer after ignition.

The largest lightning fires have historically burned in an uneven pattern influenced primarily by site topography and local winds. Up and down slope movement will generally exceed upvalley-downvalley spread on the west side of the park. Upvalley-downvalley spread is more likely on the east side. The longer the fire burns uninfluenced by significant precipitation, the further the potential upvalley-downvalley movement.

Under average fire danger conditions, most lightning fires will be low-intensity, slow-spreading fires. Flame lengths are usually less than two feet. Medium and long range spotting is rare. Under extreme burning conditions, lightning fires may escape the most efficient and rapid initial attack. Indirect attack, while using aircraft resources, is often the only option available on such high-intensity fires due to the hazards presented by the fire and rugged topography to ground forces. The presence of natural fire barriers and the prevailing weather patterns previously outlined remain the most significant factors determining the spread of fires.

Smoke Dispersal: General atmospheric stability, presence of an inversion, current total loading of airshed from other sources, impacts on smoke sensitive areas.

When managing wildland fires for resource benefit, there must be close cooperation and communication between the park and the Washington State Department of Natural Resources, Olympic National Forest, and local tribes. Though wildland fires for resources benefit are currently not addressed under the provisions of the State Implementation Plan (SIP), the park is not exempt from the requirement to manage the smoke from these fires, as part of the responsibility of managing an area that has been designated as a Class I Area. Smoke impacts on threatened and endangered species habitat is another consideration that may require further studies to determine the true effects on species. Most critical smoke sensitive areas are "downwind" from the park, and long-term incidents have the potential to create a public response. Smoke management and dispersal is a highly politicized issue, and should be carefully considered in any strategy to manage wildland fire use.

The National Weather Service Land Management Weather Forecast includes information on atmospheric stability, mixing heights and transport winds. This information is used when preparing short-term projections of smoke dispersal.

Available Resources: Availability of qualified personnel and sufficient equipment to manage the fire and take contingency suppression action as needed.

The 310-1 Interagency Qualifications Guide, and agency guidelines will be followed when assigning a qualified IC or Fire Use Manager at the appropriate management level for the complexity of the incident. One FUMA may manage several normal complexity fires.

Resources must be available to perform holding actions (if any have been identified), and contingency actions. A Type 3 Incident Commander (ICT3) must be pre-identified, and if not serving on the fire itself, must be capable of being on scene, or at the command post within three hours. If a Prescribed Fire Burn Boss or Fire Use Manager (also qualified as an ICT3) is managing several fires, an additional ICT4 must be identified in case the situation on one or more fires escalates. All personnel used directly at the fire site must be qualified, at the minimum, as Firefighter Type 2 level.

It is recommended that a Long Term Fire Behavior Analyst (LTAN) be assigned or consulted during the development of the WFIP - Stage III to provide a complete review of Maximum Manageable Areas and Wildland Fire Implementation, provide input regarding the potential of fire, assess potential risk, and make extended fire behavior predictions for comparisons of documented and/or potential fire behavior.

All wildland fire use actions will be monitored. It is recommended that qualified Fire Effects Monitors (FEMO) and Weather Observers (WOBS) be ordered to staff fires as needed.

The period of highest fire occurrence coincides with the peak visitor use season in the park and high fire occurrence throughout much of the United States. Qualified fire management personnel will not always be readily available in sufficient numbers to insure a timely suppression response if required. Unless suitable contingency forces are available, fires should be suppressed as soon as possible following discovery.

Regional Situation: Availability of contingency suppression resources from cooperating agencies; status of shared suppression resources.

The regional fire situation should be evaluated as follows:

1. Olympic National Park and cooperating agency resources available. Regional and National Preparedness Level I and II. Situation Good.

2. Olympic National Park resources committed and cooperating agency resources available. Regional Preparedness Level III and National Preparedness Level II. Situation Moderate.

3. All local resources committed. Regional Preparedness Level IV or V and National Preparedness Level III or higher. Situation Serious.

Since wildland fire use actions may require eventual containment or suppression action, the regional situation should be carefully assessed during completion of the WFIP. The situation must be reassessed periodically throughout the course of the fire.

C.3. PRE-SEASON PREPARATION

a. AGREEMENTS

Olympic National Park and Olympic National Forest (OLF) manage adjoining wilderness areas on the east and southeast side of the Olympic Peninsula. The Conditional Unit has been established along these

boundaries to facilitate joint management of wildland fire used for resources benefit across the boundaries. OLF is not able to enter into an agreement to allow joint management of fires until it has completed its Fire Plan to allow for Fires Use for Resource Benefit. Once the forest has completed its Fire Plan, the park and the forest may then manage fires across each others boundaries with no further changes to the Olympic National Park fire plan being necessary.

The park has entered into a number of other agreements. Primary agreements include the PSICC coordination center and agreements with DNR, USFWS, NPS, USFS, BIA and local tribes on fire management on the Olympic Peninsula. The park also maintains agreements with local fire districts for assistance during emergency incidents. In addition, the park has entered into an agreement with San Juan Island NHP to assist in the management of the fire management program at San Juan. At the writing of this plan, a similar agreement between Olympic NP and Lewis and Clark National Park may be undertaken. Once completed, the agreement will be added to Appendix I.

See Appendix I: Local and Sub-Geographic Agreements.

b. WEATHER/SEVERITY DATA

Information on seasonal severity is available through the Wildland Fire Assessment System (WFAS), an internet-based information system. The current system provides a national view of weather and fire potential, including national fire danger and weather maps and satellite-derived "Greenness" maps.

The fire management office will utilize WFAS information, and also track NFDRS indices for the fire weather stations on the Olympic Peninsula to identify early seasonal patterns and trends.

c. TRAINING NEEDS

All personnel who are assigned to wildland fire use actions must meet the requirements listed in the 310-1 Wildland and Prescribed Fire Qualification System Guide. All personnel who are assigned to arduous duty field positions on wildland fires used for resource benefit must be qualified, at a minimum as Type 2 Firefighters (FFT2), and must successfully complete annual firefighter refresher training and the arduous duty pack test. Because many wildland fires in the park are accessible only by helicopter, field personnel are also provided the aviation safety class and aviation refresher training.

d. PRE-PLANNED MAXIMUM MANAGEABLE AREAS (MMAs)

Preplanned MMAs have not been established. An MMA boundary will be established for each fire that reaches WFIP Stage III. MMAs may not extend outside of the Wildland Fire Use and Conditional Units, unless agreements have been established with the USFS to jointly manage wildland fire use actions across neighboring wilderness boundaries (Conditional Unit only).

C.4. WILDLAND FIRE USE IMPLEMENTATION PROCEDURES

A Wildland Fire Implementation Plan will be prepared to the extent necessary for all wildland fire use fires. The full WFIP consists of three distinct stages. Progressive development of these stages will occur for wildland fires managed for resource benefits or where initial attack is not the selected response. Objectives, fire location, predicted fire weather and fire behavior conditions and risk assessment results will indicate when various WFIP Stages must be completed. The Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide contains a full description of all WFIP stages. Application of these guidelines in Olympic National Park will include the following steps:

a. DETECTION

Detection of lightning-caused fires will primarily be accomplished by aerial reconnaissance, supplemented by ground observations by employees, residents and visitors. Ground strikes from electrical storms are recorded and plotted by Automated Lightning Detection System (ALDS) equipment in Portland, Oregon. Information on the number and location of recorded strikes is obtained at the BLM web site for lightning detection maps. The Puget Sound Interagency Center and DNR Forks fire office also have access to the ALDS system.

Following lightning storms with known ground strikes, a detection flight may be flown to search for new ignitions. The flight may be postponed due to poor weather or amount of precipitation associated with the storm. Costs for these flights are charged to an emergency preparedness account number, unless transferred to individual fires.

Olympic National Forest, the Olympic Region of the Washington Department of Natural Resources and the park informally cooperate in aerial detection to provide the widest possible coverage of the Olympic Peninsula. Each agency may increase the frequency and coverage of their detection flights to include lands of an adjacent cooperating agency upon request, subject to the provisions of existing agreements.

The complex topography of the park makes a systematic and comprehensive detection flight pattern difficult to plan. Light fixed wing aircraft flying 500-1,000 feet above the terrain at airspeeds of 90-100 knots yields the best results per cost factor. The timing of flights in relation to time of day and the burning period can be crucial in spotting low intensity fires. Experienced observers are mandatory. Reconnaissance flights may require consultation with U.S. Fish and Wildlife Service.

In an attempt to standardize the detection flights as much as possible, three primary detection routes are identified in the map section of this plan. Alpha pattern is an abbreviated pattern designed to cover the Exclusion Unit and exterior park boundary. The Bravo and Charley patterns are designed for increasingly detailed coverage of parklands. The actual flight pattern used depends on Staffing Class, weather conditions, and storm patterns.

The park maintains the former Dodger Point lookout as a backcountry patrol cabin. Located in the Elwha River drainage, the lookout commands a view of that portion of the park with the highest historical occurrence of lightning fires. The lookout can be utilized for detection purposes during periods of high fire danger.

Hurricane Ridge, Deer Park, Four Stream, Queets Ridge and Higley Peak roads are accessible by vehicle, and are often good vantage points for initial detection.

b. INITIAL REPORT OF FIRE

Fires are reported to the Headquarters Communication Center (Dispatch) and relayed to the FMO and District or Sub-district Ranger for action via radio, telephone or pager.

Fires in the Exclusion Unit and human-caused fires in the Conditional Unit and Wildland Fire Use Unit will receive the appropriate suppression response. Initial attack on unwanted fires is the responsibility of the FMO, with coordination with the District Ranger, under the procedures outlined in Chapter IV Section C.

The response to new lightning fires in the Conditional and Wildland Fire Use Units depends on the assessment conducted in WFIP Stage I, augmented by the OLYM Decision Chart.

c. WFIP STAGE 1: INITIAL FIRE ASSESSMENT AND OLYM DECISION CHART

WFIP Stage I: Initial Fire Assessment, includes the Fire Situation and the Decision Criteria Checklist. It is completed within two hours of when the fire is verified. It documents the current and predicted situation, documents all appropriate administrative information, and aids managers by providing them with decision criteria to make the initial decision whether to manage the fire for resource benefits or to take suppression action. The OLYM Decision Chart augments the Decision Criteria Checklist. In locations or circumstances where suppression is the only appropriate response (as in the Exclusion Unit), the requirement for a decision checklist as part of the Stage I analysis is considered to be met.

Many wildland fires occur in high elevations, remote areas, or areas surrounded by sparse fuels, and have little or no chance of ever requiring any management action other than monitoring. They are often single tree fires, or may be larger but surrounded by strong natural barriers, These fires may require only a WFIP Stage I: Initial Fire Assessment and Periodic Fire Assessment. If the Fire Management Officer or designee determines that this is the case, the decision process, analysis of alternatives, and daily re-certification checklist may be the record of decision. If, at a later date it develops that additional management will be needed, such as firing, holding, or trail closures, additional stages of the Wildland Fire Implementation Plan detailing the management strategy and planned implementation actions for the fire will be submitted to the superintendent or acting superintendent for review and approval.

Fire Situation

When a new ignition is discovered, the FMO ensures that the fire is sized up, and a Fire Situation form is completed. This form is described in detail in the Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide, and is reproduced in Appendix Q: Commonly Used Forms. The Fire Situation form documents the initial size-up of the fire, including the following elements:

- Fire Name
    - Fire Number
    - Jurisdictions(s)
    - Administrative unit(s)
    - Geographic area(s)
    - Management code(s)
    - Start date/time
    - Discovery date/time
    - Current Size
    - Location
    - Cause
    - Fuel model(s)/conditions
    - Current Weather
    - Forecasted weather
    - Current fire behavior
    - Forecasted fire behavior
    - Availability of resources

A topographic map should be attached to the Situation Report, showing the fire location and projected fire growth for the following burning period in relation to FMU boundaries and values-to-be-protected.

OLYM Decision Chart

The OLYM Decision Chart should be completed after information has been gathered for the Fire Situation form. The OLYM Decision Chart provides information that aids in the completion of the Decision Criteria Checklist. (The chart can also be used when reassessing the fire situation, however a few criteria, as noted below, are applied only during the initial assessment.)

Table 4.3 OLYM Decision Chart

Each Decision Factor is evaluated. If evaluation criteria cannot be met or the concerns cannot be mitigated, a suppression-oriented appropriate management response should be recommended. Each of the four sections of the OLYM Decision Chart corresponds to the first four questions on the Decision Criteria Checklist, and are designed to assist in the completion of the checklist.

DECISION FACTOR	**EVALUATION CRITERIA**
I. Threats to life, property and resources:	
Fire cause	Fire is lightning-caused (exceptions may be made to this requirement in the Wildland Fire Use and Conditional Units if NPS policy changes to allow consideration of some human-caused fires)
Fire Management Unit (FMU)	Fire is within the Wildland Fire Use or Conditional Units, and can be contained within these units given current and expected fire weather. Some fires in the Conditional Unit may be allowed to burn outside the unit if agreements have been established with the USFS for joint management of these fires.
Immediate and projected threats to life and property.	There are no threats, or threats can be adequately mitigated.
Immediate and potential impacts to visitors, users and local communities.	There are no impacts, or impacts can be adequately mitigated.
II. Potential effects on cultural and natural resources	
Immediate and projected threats to cultural and historic resources.	Impacts of fire on historic and cultural resources are within the range of effects described in Chapter IV Section C.5.a. of this plan, and in the Fire Management Plan EA. No additional concerns have been identified, or newly identified concerns can be mitigated.
Immediate and projected threats to air quality and visibility, with special consideration given to sensitive receptors and scenic viewpoints.	Impacts of fire on air quality and visibility are within the range of effects described in Chapter IV Section C.5.a. of this plan, and in the Fire Management Plan EA. No additional concerns have been identified, or newly identified concerns can be mitigated.
Immediate and projected threats to rare, sensitive, threatened and endangered species.	Impacts of fire on rare, sensitive, threatened and endangered resources are within the acceptable range of effects described in the Fire Management Plan EA. No additional concerns have been identified or newly identified concerns can be mitigated. If the fire is between April 1 and Aug 5, or if the fire goes to a crown fire and individual patch size reaches 10 acres or more, the fire should be classified as a suppression fire to limit loss of nest trees, to protect spotted owls and murrelets young that are still in the nest.
Wilderness considerations.	Management of this ignition as a wildland fire used for resource benefit will support wilderness goals.

III. Relative Risk Indicators and Risk Assessment	
Current 1000-Hour Timelag Fuel Moisture (1000-hr FM) for representative fire weather station(s).	The 1000-hr FM is higher than 12 percent.
Current Energy Release Component (ERC) for representative fire weather station(s).	The ERC has been below 30 for the past 3 days. (this criteria applies only to the initial assessment)
Staffing Class	The park is in Staffing Class I-IV. If the park is in level III or IV, each proposed new wildland fire use will be analyzed by the FMO on a case-by case basis, considering fuels, potential spread, predicted fire weather, natural barriers, time of fire season, management goals for an area, and regional and national preparedness levels. No new wildland fires will be managed for resource benefits at staffing class V. On-going fires will be carefully evaluated.
Number of active fires in the park (including wildland fires used for resource benefit and suppression-oriented fires)	There are fewer than 6 active fires larger than 10 acres. (Active status is defined as a burning period in which fire perimeter growth is expected to increase by 10% or 10 acres, whichever is less.)
Projected fire growth under normal and drought conditions.	Projected fire can be contained within unit boundaries, within desired acreages, and within desired fire effects.
Relative risk rating (based on time of season, fire size, potential complexity, and fire danger indicators)	Level of risk is acceptable. Normally a low or moderate risk rating will be acceptable. There may be exceptions where a high risk would be acceptable, for example when the fire occurs in a very remote location and has adequate natural barriers.

IV. Proximate Fire Activity	
The National Fire Preparedness Level.	National fire preparedness at level III or lower; OR National fire preparedness level is IV and Region has approved this candidate fire (applies only to initial assessment). At preparedness level IV or higher, any new or on-going fires will be carefully re-evaluated, and will be continued as wildland fires for resource benefit only with regional concurrence.
The Regional Fire Preparedness Level	Regional fire preparedness at level III or lower (applies only to initial assessment). At preparedness level IV or higher any new or on-going fires will be carefully re-evaluated, and will be continued as wildland fires for resource benefit only with regional concurrence.
Local fire activity	If there are project fires currently burning on the Peninsula, the candidate or existing wildland fire used for resource benefit must be carefully evaluated for its potential need for resources. If resources are available to cover expected needs, then the fire may be managed as a wildland fire use action.
Availability of qualified IC/Prescribed Fire Burn Boss/Fire Use Manager	A qualified IC/Burn Boss at the appropriate management level for the complexity of the incident

	is available. One IC/Burn Boss may manage several normal complexity fires. A Fire Use Manager is required when more than five fires of Class B size or larger are occurring at the same time.
Availability of monitoring resources.	Resources are available to monitor the fire. On Class A and B fires the IC/Burn Boss may fill this role.
Availability of holding and contingency resources	Resources are available to perform holding actions (if any have been identified), and contingency actions. An Incident Commander Type III must be pre-identified and if not serving on the fire itself, must be capable of being on scene, or at the command post within two hours.
Availability of Resource Advisors	A Natural Resource Advisor is available for fires of Class C or larger; and a Cultural Resource Advisor is available for all fires of Class C size and larger (if needed for the site).
Availability of funding	Funds are available to manage a wildland fire used for resource benefit.

Decision Criteria Checklist

The Decision Criteria Checklist is described in detail in the Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide, and is reproduced in Appendix Q: Commonly Used Forms. The Decision Criteria Checklist is a process to assess whether or not the situation warrants continued wildland fire use implementation. A "Yes" response to any element on the checklist indicates that the appropriate management response should be suppression-oriented. The Recommended Response Action documents the Go/No-Go recommendation. The superintendent (or other designated individual) must sign the Decision Criteria Checklist.

The Decision Elements on the checklist include:
- Is there a threat to life, property, or resources that cannot be mitigated?
- Are potential effects on cultural and natural resources outside the range of acceptable effects?
- Are relative risk indicators and/or risk assessment results unacceptable to the appropriate Agency
- Administrator?
- Is there other proximate fire activity that limits or precludes successful management of this fire?
- Are there other Agency Administrator issues that preclude wildland fire use?

d. WFIP STAGE II: SHORT-TERM IMPLEMENTATION ACTIONS

WFIP Stage II: Short-Term Implementation Actions, represents the initiation of management for resource benefits. During this stage, the potential fire behavior is calculated; uncertainty is reduced by assessing risk of the fire, how quickly it could spread, and how intense the fire may burn; fire complexity; necessary immediate and short-term management actions and resources; and evaluation of the need to move directly to the Stage III section. This stage is completed within 24 hours of the initial go/no go decision to manage the ignition as a wildland fire use fire.

WFIP Stage II: Short-Term Implementation Actions includes the following components:
- Short term fire behavior predictions for different scenarios
- Risk assessment (may vary in detail and range from relative risk rating to quantitative analysis results)

- Short-term implementation actions (this section includes the following information)
  - Objectives and desired effects
  - Safety considerations
  - External concerns
  - Environmental concerns
  - Threats
  - Short-term implementation actions (include description of action and expected duration)
  - Estimated costs
  - Signatures
- Complexity Rating Worksheet (this section includes the following complexity elements)
  - Safety
  - Threats to boundaries
  - Fuels and fire behavior
  - Objectives
  - Management organization
  - Improvements to be protected
  - Natural, cultural, and social values to be protected
  - Air quality values to be protected
  - Logistics
  - Political concerns
  - Tactical concerns
  - Interagency coordination
- Stage III Needs Assessment Chart

e. WFIP STAGE III: LONG-TERM ASSESSMENT AND IMPLEMENTATION ACTIONS

WFIP Stage III: Long-Term Assessment and Implementation Actions is triggered by either the Stage III Need Assessment Chart (WFIP Stage II) or through the Periodic Fire Assessment, Part 2, Stage III Need Assessment Chart. Stage III provides a definition of the ultimate acceptable geographic size of the fire (represented by the Maximum Manageable Area -MMA). It considers long-term fire behavior predictions and long-term risk assessment. It assesses the likelihood of the fire reaching the MMA perimeter, and documents those operational management actions necessary to manage long duration fires that will need mitigating measures to strengthen and defend the MMA.

WFIP Stage III: Long-term Implementation Actions includes the following components:
- Objectives and Risk Assessment Considerations
- Maximum Manageable Area (MMA) Definition and Maps
- Fire Projections and Maps
- Fire Projections and Maps
- Weather season/drought discussion and prognosis
- Long Term Risk Assessment (describe techniques and outputs, include maps as appropriate)
- Probability of Success
- Threats
- Threats to MMA
- Threats to Public Use and Firefighter Safety
- Smoke dispersion and effects
- Other
- Monitoring Actions (actions, frequency, and duration)

- Holding Actions (describe holding actions, management action points that initiate these actions and key to map if necessary)
- Resources needed to manage the fire
- Estimated Costs of long-term implementation actions
- Contingency Actions (describe contingency actions, management action points that initiate them, and resources needed)
- Information Plan
- Post-burn Evaluation
- Signatures and Date

f. PERIODIC ASSESSMENT OF WILDLAND FIRE USE APPLICATIONS

For each wildland fire use action, the Superintendent (or delegated individual) is required to periodically validate the level of implementation actions and affirm the capability to continue management of the fire. This procedure is intended to prevent the unchecked escalation of an individual fire situation or the total fire management situation without evaluation and adequate planning. Assessment consists of three components: a revalidation of the appropriateness of continued management for resource benefits, an assessment of the need to progress from WFIP Stage II to Stage III, and a signature table that affirms the Superintendent's concurrence. The Periodic Fire Assessment forms are reproduced in Appendix Q: Commonly Used Forms.

The Part 1 checklist essentially consists of the same decision elements present in the Decision Criteria Checklist, with the addition of the decision element, "Do expected management needs for this fire exceed known capabilities?" Part 2 of this assessment consists of the same chart utilized in the Stage II final assessment (Stage III Need Assessment Chart).

The Superintendent or designated individual must sign the Periodic Fire Assessment signature page on the specified assessment frequency for the time period encompassed by the valid dates. The assessment frequency will be determined in the WFIP process and may be adjusted as the complexity of the fire changes. The Periodic Fire Assessment signature authority can be re-delegated to specific positions as appropriate. Agency administrators can delegate, in writing, the revalidation authority to other designated individuals. This permits the delegated authority to affirm that management capability exists to continue to manage the fire for resource benefit. If or when fire conditions or complexity levels escalate, Periodic Fire Assessment signature authority will automatically and immediately revert to the agency administrator who made the initial delegation of authority. For a particular fire, the responsible agency administrator can make the decision regarding delegation of this authority.

The specific assessment frequency is determined in the WFIP process. Table 4.4 presents general guidelines based on past experience with fire in these forest fuels. In the Olympics, fire intensity and fire spread is usually slow at the lower staffing class levels, and the fire situation changes slowly. At higher staffing class levels the situation can change more rapidly and a more frequent assessment is recommended.

Table 4.4. Recommended Frequency for Periodic Fire Assessment in Olympic National Park

Fire Situation	Assessment Frequency
Initial management of a wildland fire use action, to continue until the WFIP – Stage 2 has been approved.	Every day.
Staffing Class Level (based on the ERC) is 1-3 at applicable fire weather stations.	Every 5 days, or more frequently, as specified in the WFIP.

Staffing Class Level (based on the ERC) is 4-5 at applicable fire weather stations.	Every 3 days, or more frequently, as specified in the WFIP
Complexity levels are rapidly escalating, or red flag warnings are in effect.	Every day.

g. WILDLAND FIRE USE PROGRAM OVERSIGHT

Regional office fire management officers are responsible for appraising and surveying all wildland fire use activities within their region. The regional office fire staff will review implementation plans for fires with a Complex Rating. Direct contact with parks may be necessary to stay apprised of complex situations. On rare occasions, circumstances or situations may exist which require the regional director to intervene in the decision process for wildland fire use.

Review by the regional fire management officer or acting is mandatory for Wildland Fire Implementation Plans with a projected cost of greater than $500,000. Review by the NPS National Fire Management Officer at NIFC, or Acting is mandatory for Wildland Fire Implementation Plans with a projected cost of greater than $1,000,000.

h. WILDLAND FIRE SITUATION ANALYSIS

If an ongoing wildland fire use action does not meet desired objectives, exceeds the WFIP, or if external concerns (such as multiple new starts in the area) make it inadvisable to continue the action, the fire will be considered an unwanted fire and a Wildland Fire Situation Analysis (WFSA) will be prepared to guide a fire suppression action. The WFSA is a decision-making process in which the agency administrator or representative describes the situation, establishes objectives and constraints for the management of the fire, compares multiple strategic wildland fire management alternatives, evaluates the expected effects of the alternatives, selects the preferred alternative, and documents the decision.

Components of the WFSA include:
- WFSA initiation section (specific fire information and date/time initiated)
- WFSA completion/final review (information concerning when the selected alternative was achieved or when a new WFSA was prepared. This provides closure to this particular WFSA. Also includes agency administrator signature).
- Wildland Fire Situation Analysis (WFSA Information Page)
- Objectives and Constraints
- Alternatives
- Evaluation of Alternatives
- Analysis Summary
- Decision
- Daily Review
- Guide for Assessing Fire Complexity (evaluates fire conditions and provides recommendations concerning management level of fire, i.e., Type 1, Type 2, Type 3).

C.5. POTENTIAL IMPACTS OF PLAN IMPLEMENTATION AND MITIGATION MEASURES

a. POTENTIAL IMPACTS

Table 4.5 below summarizes the potential impacts of the plan implementation, both on and off site. See the Wildland Fire Management Plan Environmental Assessment for a more detailed discussion of the potential impacts.

Table 4.5: Potential Impacts of Wildland Fire Use and Suppression Actions*
***(Impacts listed are generic and would vary in range and intensity based on type of fire, topography, aspect, and weather)**

Air Quality	Temporary effects on air quality and Class I Area visibility could result from suppression fires and wildland fire use – most smoke would be in remote areas. Burned acreage could increase over a program of exclusive fire suppression by 1,545 acres in a peak year, with a proportional increase in smoke. Effects are expected to be within natural range of variability, reflecting natural effects of fire. Smoke mitigation measures may be applied to limit the impact to air quality. The park's ecosystem and wilderness values may take short-term precedence over the air quality and visibility values.
Water Resources	Minor and/or short term effects on sediment load due to soil erosion or mudslides could result from natural effects of infrequent large or very large fires (both suppression and wildland fire use). Effects are expected to be within natural range of variability. Additional short-term sedimentation or contamination are possible from holding or fire suppression actions (construction of handlines, mop-up, and use of foam or retardant) – these will be minimized through Minimum Impact Tactics (MIT) and emergency spill response.
Soil Resources	Minor and/or short term increases in soil erosion or mudslides could result from natural effects of infrequent large or very large suppression fires and wildland fire use fires. Impacts are expected to be within natural range of variability. Additional short-term soil erosion are possible from fire suppression activities (construction of handlines and mop-up), however, MIT will minimize these impacts.
Wilderness	Temporary noise impacts (chainsaws, helicopters) are possible from holding, monitoring, and suppression activities. Minimum requirement assessment will be applied to wilderness operations to maintain wilderness character. Visual impacts from suppression (cut stumps and firelines), will be mitigated through MIT and post-fire rehabilitation. Temporary impacts from smoke may impact wilderness visibility. Wildland fire use management will help re-establish fire as a natural wilderness process.
Vegetation Resources	Wildland fire use promotes the restoration of natural fire regimes. Plant habitat and diversity improved. Potential invasion of non-native species on disturbed sites will be mitigated through MIT, monitoring and removal.
Wildlife Resources	Suppression, and wildland fire use will temporarily displace some wildlife individuals; isolated mortality of individuals is likely from infrequent large or very large fires (both suppression and wildland fire use). Generally, wildlife habitat improved in the long term with restoration of natural fire regimes.

Fish and Aquatic Resources	Minor and/or short term increases in sediment load due to soil erosion or mudslides could result from natural effects of infrequent large or very large fires. Impacts could include increased water temperatures, chemical toxicity from smoke, changes in pH, and increased levels of chemical concentrations. Additional short-term sedimentation or contamination is possible from holding or suppression activities (construction of handlines, mop-up, and use of foam or retardant), however, MIT and emergency spill response would minimize these impacts. Riparian habitats are one of the most ecologically productive and diverse terrestrial environments. The area adjacent to the river links terrestrial and aquatic ecosystems, influences channel processes, contributes organic debris to streams, and modifies water temperatures. Any increases in water temperature as a result of removal of trees and vegetation may degrade water quality conditions including fish habitat. Loss of vegetation may reduce nutrient inputs to streams. Establishment of riparian buffers (of up to 250-foot no-touch along fish-bearing streams) would reduce most of these impacts making them minor and short term.
Threatened, Endangered and Rare/ Sensitive Species	There may be minor and/or short-term impact on T&E or sensitive species habitat. Fire management activities will temporarily disturb (noise) or displace (burned vegetation, smoke) some wildlife individuals. Isolated mortality of individuals is likely from infrequent large or very large fires and rarely from smaller fires, and from associated fire management activities.
Cultural Resources	There may be minor impacts to cultural resources. Known cultural sites will receive fire protection, if firefighter safety is not compromised. Mitigation measures will reduce the risk of accidental damage to un-recorded sites from suppression and wildland fire use fires.
Socioeconomic	Minor effects on local and regional economy are possible; no adverse impact to poor and minority populations are expected. Loss of visitor revenues during large or very large fires will be offset to a degree by goods and services purchased from the community to support fire suppression and fire management activities.
Human Health and Safety	Safety risks of fire management activities will be mitigated through established safety precautions. There is potential for limited exposure to smoke by firefighters and public. Smoke mitigation measures will be applied to all types of wildland and prescribed fire use, limiting the impact to human health and safety.
Visitor Experience	Minor and short-term impacts are possible during infrequent large or very large fires (both suppression and wildland fire use), with possible temporary trail or area closures; some views obscured; and minor exposure to smoke. Noise from hazard fuel reduction could cause temporary impact to visitors in nearby areas. Impacts will be reduced through public information.

b. MITIGATION

This section provides an overview of mitigation measures. For a more detailed discussion of mitigation actions see Chapter X and the Wildland Fire Management Plan Environmental Assessment.

Overview

Only fires within the Wildland Fire Use Unit or Conditional Unit will be considered for management as wildland fire use fires. Fires outside these units and fires that could not be contained in these units will be managed under a suppression strategy.

For the protection of air quality and important habitat, the area burned each year through wildland fire use will be limited to 200 acres (81 ha) per year in areas where there is suitable habitat for Northern Spotted Owls

or Marbled Murrelets, with an allowance for an additional 600 acres (243 ha) to be managed as wildland fire use in one year out of five. In addition, limit wildland fire use to 500 acres (202 ha) per year in areas outside of suitable habitat. Wildland Fire Use that has potential to exceed these acreage figures, but meets all other wildland fire use criteria, will be considered candidates for wildland fire use management only with additional environmental analysis and consultation. Limit stand replacement patch size to 10 acres or less between April 1 and August 5. If patch size exceeds 10 acres, the fire will be converted to be managed under a suppression strategy.

Candidate wildland fire use actions will be evaluated for their individual and cumulative impacts on air quality and visibility, with close consideration of potential impacts to viewpoints, including but not limited to those at Lookout Rock, Hurricane Ridge, Hurricane Hill and Deer Park.

A Wildland Fire Implementation Plan (WFIP) will be prepared for each wildland fire use action.

The park's Minimum Requirement Process (Appendix E) will be used to help guide the response to wildland fires in the wilderness, and the choice of minimum tool for these operations.

Holding actions taken on wildland fire use fires will be guided by Minimum Impact Tactics (also referred to as Minimum Impact Fire Suppression Techniques). Minimum Impact Tactics modified for ONP are contained in Appendix F.

If a wildland fire use fire occurs near a site where special category plants are known to occur, natural resource management staff will be consulted to determine if a resource advisor should be assigned to the fire. Under some circumstances, there may be no threat to the special category plants, while under other circumstances special precautions will be needed. The resource advisor will help identify measures to protect special category plants from the potentially adverse effects of holding actions, and/or support activities (such as helispots, staging areas, spike camps, etc.), while avoiding interference with natural fire processes as much as possible. See Wildland Fire Management Plan Environmental Assessment Appendix F-2 for a listing of special category plants.

The Wildland Fire Implementation Plan for each Wildland Fire Use project will identify any additional precautions needed for specific projects, such as coordination with affected residents who have special health concerns related to smoke. Residents and individuals who could be affected by a particular Wildland Fire Use project will be notified by the park through press releases, and/or individual contact as appropriate. Information will be provided regarding measures that individuals can take to minimize their exposure to smoke.

All wildland fire use actions will be monitored to ensure protection of human life, property, and natural/cultural resources; to assist with contingency planning; and to monitor smoke emissions for identification of health concerns.

If an ongoing wildland fire use action no longer meets desired objectives, exceeds the Maximum Manageable Area, or if external concerns (such as multiple new starts in the area) make it inadvisable to continue the action, the fire will be considered an unwanted fire and a WFSA will be prepared to guide a fire suppression action.

Safety guidelines described in the National Wildfire Coordinating Group's Fireline Handbook and Pocket Guide will be employed on all wildland fire use actions. Job Hazard Analyses will be prepared or updated prior to each fire season. All personnel involved in fire management activities will meet the current NPS wildland fire qualification standards to include accepted interagency competencies (knowledge, skills, and abilities) where appropriate.

C.6. KEY STAFF POSITIONS FOR WILDLAND FIRE USE

See Chapter V. Fire Management Organization and Responsibilities.

C.7. PUBLIC INFORMATION AND INTERPRETATION OF WILDLAND FIRE USE

See Chapter IX. Public Information and Education.

C.8. PERMANENT PROJECT RECORD

The following is a standard outline of contents for a permanent project record for each wildland fire use application.

	Item	Who is responsible, Where documents are kept.
a.	DI-1202 Individual Fire Report and Narrative.	Prepared by the IC or a member of the fire management staff, and submitted to the FMO for approval. The Fire Program Assistant enters the DI-1202 into WFMI within seven days of being declared out and files a hard copy in the incident files in the fire management office.
b.	Approved planning document that guided management actions (e.g., WFIP, and/or WFSA). Include all amendments and revisions.	Prepared by the FMO or designee. The Fire Program Assistant stores them in the incident files.
c.	Revalidation and certification documents (if applicable).	These are signed by the Superintendent or designee. They are filed with the WFSA.
d.	Daily weather forecasts and spot weather forecasts.	The Fire Program Assistant is responsible for printing the daily weather forecasts and any spot forecasts that are requested by the Incident Commander or FMO. The Fire Program Assistant stores a copy in the incident files.
e	Monitoring reports, including (if applicable) a summary of all monitoring activities, summaries of findings, and photopoints. (level 1 and 2 monitoring)	This is completed by the fire monitor. The Fire Program Assistant stores the monitoring information in the incident files.
f	Funding codes	The Fire Program Assistant maintains a log of all wildland fire use accounts, and, requests the budget office to establish a new account for each incident or complex.
g	Cost accounting	The Fire Program Assistant files all timesheets and obligating documents for each incident in the incident files.
h.	Total cost summary	This is prepared by the FMO or a member of the fire management staff based on information in obligating documents and AFS3 printouts.
i.	Project maps. Cumulative fire map showing acreage increase by day. Also include maps of helicopter flights documented with Global Positioning System equipment.	The Fire Program Assistant stores hard copy maps in the incident files. All fires will be mapped. All fires greater than 100 acres are to be permanently mapped and archived. GPS/GIS data is submitted to the park's GIS office for inclusion in the GIS database.
j.	Overhead and Crew Evaluations (as applicable)	The Incident Commander is responsible for completing overhead and crew evaluations. The Fire Program Assistant stores these in the incident files, with a copy in individual's

		folders in the fire management files.
k.	Experience Records	The Fire Program Assistant is responsible for entering fire experience into the IQCS (or current national computer system).
l.	Other information, as appropriate, for the situation, such as location of helispots.	This information will be kept in the incident files, and in GIS records as appropriate.

These records will reside in the fire management office. The Fire Program Assistant will be responsible for file maintenance.

C.9. FUNDING/FISCAL TRACKING FOR WILDLAND FIRE

The Fire Program Assistant will maintain a log of all wildland fire use accounts, and, submit a request to the Puget Sound Interagency Communication Center and the park's budget office to establish a new account for each incident or complex in the park that meets requirements to have a unique account number assigned. The Fire Program Assistant will file all timesheets and obligating documents for each incident in the incident files. A total cost summary will be prepared by the FMO or a member of the fire management staff based on information in obligating documents and AFS3 printouts.

D. PRESCRIBED FIRE

Prescribed Fire is any fire ignited by management actions to meet specific objectives. The fuels to be burned may be in either their natural or modified state. The prescribed burn takes place under specified environmental conditions (e.g. weather and fuel moisture); is confined to a predetermined area; is within a range of fire intensity and rate of spread that permits attainment of planned management objectives; and is conducted in conformance with an approved prescribed fire plan that meets NEPA and NHPA requirements prior to ignition.

Pile burns and broadcast burns are two methods of using prescribed fire. Pile burning is used to dispose of vegetative material that has been concentrated by manual or mechanical methods. Piles are located in a wildland fuels environment where fire may spread beyond the pile perimeter. Broadcast burns are prescribed fire applied to wildland fuels scattered over an area. An approved prescribed fire plan is required for all prescribed fires prior to ignition. Debris disposal is burning of wildland fuels deemed infeasible or impractical to mechanically remove and must be in a non-wildland fuel environment (parking lot, boneyard, gravel pit, etc.) Any material being burned for debris disposal must be classified as permissible to burn under applicable Federal, State, Tribal and Local regulations.

The various counties on the Olympic Peninsula have imposed a permanent burn ban of open burning (i.e., burn piles) during the period between July 1 and October 1, in an attempt to reduce additional human caused fires during the fire season. Although this ban does not technically affect the park, due to its exclusive jurisdiction, the park has agreed to abide by this ban for all pile burning. Occasionally, the park will need to conduct resource management burns, as the objectives can only be met with a summertime burn. The counties are in agreement with allowing resource management agencies to continue conducting resource management burns.

Detailed NPS guidelines regarding Fuels Management are contained in NPS Reference Manual 18 Wildland Fire Management, Chapter10.

D.1. PLANNING AND DOCUMENTATION

a. ANNUAL PREPARATION

Yearly preparedness meetings are held in late April with the Olympic National Forest, DNR, BIA and tribes. These meetings are designed to determine where resources are, insuring utilization of the closest forces concept and to identify where each agency can assist the other agencies.

The Olympic National Park fire cache will be inventoried and readied by mid-May of each year. This will include insuring that all engines and pumps are in a ready state. Any identified shortages of supplies will be promptly ordered to bring the fire cache back to a readiness state prior to the June fire season.

A readiness review of the park's fire operation will be conducted prior to July 15 each year. The BLM readiness reviews are the current standard that is being utilized. Topics that will be reviewed include engine and crew readiness, fire cache preparedness, dispatching capability, training and administrative capabilities.

Prior to the beginning of the season, plans for fuels management projects, prescribed burns and pile burning projects will be completed. All planning will be conducted as a collaborative process between fire, maintenance, resource management and cultural resources. Park resource education staff will be involved when a message needs to be distributed to the public. Fire hazard analysis of park structures and inholder properties will be reviewed and updated as needed.

The National Park Service utilizes the job hazard analysis system to identify potential hazards to its workforce. A master catalog of identified hazards to fire and aviation management activities is maintained in the fire office and at district caches and will be reviewed and updated as necessary prior to the fire season.

b. LONG-TERM PRESCRIBED FIRE STRATEGY

Prescribed fire will be used in Olympic National Park to dispose of burn piles (from hazard fuel reduction and maintenance activities) and to conduct research burns. It may also be used to maintain historic landscapes in locations such as the Smith Place, and aid in the removal of invasive species.

Prescribed fire pile burning will be used to dispose of piles of woody debris that result from hazard fuel reduction manual/mechanical treatment. Hazard fuel reduction projects are located in all three FMUs, with the greatest concentration in the Exclusion Unit. See Appendix K: Five Year Project Plan.

Prescribed fire broadcast burns will be used to conduct research on the community response to fire in the Morse Creek drainage and investigate whether these 200+ year old forests dominated by Douglas fir can support low intensity, low severity fires. More specifically, it will test the hypotheses that Douglas fir stands in this drainage can carry fire through the understory without canopy involvement; that species composition will be maintained; that dominant species have strategies that allow individual plants to persist and flourish on the post fire site; and that fuels will be reduced to non-critical levels. Six or seven experimental plots of about ½ acre (0.2 ha) each will be broadcast prescribed burned. All plots will be located in the Maiden Creek sub-drainage, west of the Deer Park Road (in the Exclusion Unit).
Data to be gathered before and after the fire include:
a. Understory species: frequency, cover; top-kill or mortality; re-sprouting; reseeding.
b. Tree seedlings: mortality; reseeding
c. Overstory trees: scorch height (trunk and foliage); percent canopy scorched; ring widths (5-10 years post fire only)
d. Fuels: load; sizes; duff depth; litter depth

Prescribed fire is also being considered as a potential tool for maintaining cultural scenes and practices at Higley Homestead, the Smith Place, Ahlstrom's Prairie, and Roose's Prairie. Further analysis will be required prior to implementation of this tool in the prairies. All of these projects are located in the Exclusion Unit. (See Five-year Plan in Appendix K)

A maximum of 125 acres (51 ha) may be treated over the next five years using broadcast prescribed burns, with no more than 65 acres (26 ha) treated in any one year. These acreage figures do not include pile burning to remove piles generated by manual/ mechanical treatment under the hazard fuel reduction program. (Up to 200 acres per year will be treated for hazard fuel reduction, as described below under manual/ mechanical treatment.)

c. PERSONNEL REQUIREMENTS

All positions assigned to prescribed fires will meet all national requirements for training and experience.

A certified Prescribed Fire Burn Boss Type 2 or Type 1 (RXB2, RXB1) must implement all prescribed fires. The required level of prescribed fire burn boss will be determined by using the Prescribed Fire Complexity Rating Guide and consensus between the Fire Management Officer and the Superintendent. NPS Burn Bosses will be certified with task books to conduct prescribed fires in specific fuel types and complexity. The Burn Boss assigned to a park project may be from another agency, so long as he/she is a certified burn boss by that agency in that fuel type which the park wants to burn.

Olympic National Park's Fuels Specialist will be responsible for preparing prescribed fire burn plans for hazard fuel reduction projects and broadcast prescribed burns. The prescribed fire plan for each project will describe the personnel required to execute that project. For prescribed fire pile burns the minimum staffing will include a Prescribed Fire Burn Boss (RXB3) and a Firefighter Type 2 (FFT2).

d. MONITORING

A Fire Monitoring Plan Outline is included in Appendix H. As current standards for fire monitoring are being written at this time, the Park fire monitoring plan will be developed in more detail during the 5-year period of this plan.

The primary aim of monitoring is to provide information to fire and resource managers which allows them to affirm that treatment objectives (whether prescribed fire, fire use, or non- fire) are being met or to identify and correct deficiencies. Monitoring involves the systematic collection and recording of fuels, vegetation, topography, weather, air quality, and fire behavior data. Fire and resource staff will follow monitoring protocols derived from the National Park Service Fire Monitoring Handbook (FMH), Measuring and Monitoring Plant Populations (Elzinga et al, 1998), and other monitoring systems developed for fire management activities. No Park Service-wide monitoring standards have been established for hazard fuel reduction projects in the wildland-urban interface areas. A variety of monitoring techniques may be used depending on what type of treatment is being conducted and what variables are to be monitored.

The FMH identifies four levels of monitoring:
- Level 1 – Environmental
- Level 2 – Fire Observation
- Level 3 – Short-term Change
- Level 4 – Long-term Change

Fire management activities will be monitored at the appropriate level in relation to the type and scale of each project. For prescribed fires, this will usually include monitoring levels 1, 2, 3 and 4. The intensity and character of monitoring will vary with the complexity and purpose of each burn. Initially, this will involve on-site measurements and observations conducted by fire management personnel. Prescribed burn monitoring must determine whether or not the fire is behaving as predicted (i.e., whether or not the fire is burning within prescription parameters) and if resource management objectives are being achieved. The resource management objectives, monitoring objectives, and variables to be monitored will vary depending on the purpose of the burn (e.g. reduction of non-native species, or removal of invading shrubs, etc.), and will be described in the prescribed fire burn plan. Where possible, the sample size and other statistical issues will be addressed following the Fire Management Handbook. In other cases, park staff or outside experts will provide statistical advice. Where changes in fuels or alteration of habitat are desired, monitoring will continue over a period of years. All prescribed burns will be evaluated and critiqued by fire and resource management staff soon after burn completion. Fires that involve long-term effects will have monitoring completed as specified by monitoring protocols.

Prescribed fires for research purposes may use the research design to monitor the effects of the burn. Research burns will be monitored on site during the implementation of the burn and immediately after to document first hand fire effects. Results from the research will be used to assess and develop future management actions.

All prescribed fire monitoring information will be stored with a copy of the burn plan in the fire management office. All prescribed fire monitoring documentation will be kept with the plan, whether originals or photocopies, including slides and/or photos from the fire.

After every prescribed fire, an after action review will be conducted to critique the fire. The Interagency Standards for Fire and Fire Aviation Operations guidelines can be utilized as a format.

e. CRITQUE OF PRESCRIBED FIRE PROJECTS

Each prescribed fire project will have an after action review conducted once the project is completed. Guidelines for conducting an after action review are located within the “Red Book”.

f. REQUIRED REPORTS AND DOCUMENTATION

All prescribed fires will be documented with the following information, stored in an individual fire folder and maintained in the fire management office files.

- Original Signed Prescribed Fire Plan
- Checklist of Pre-Burn Prescribed Fire Activities (no specific form)
- All Reviewer Comments
- All Maps (including maps of project and surrounding area)
- Notification Checklist
- Permits such as burn, smoke, etc.
- Weather forecasts: spot, short- and long-term
- Monitoring data, including weather, fire behavior, and fire effects observations
- Agency Administrator Go/No-Go Pre-Ignition Approval
- Operational Go/No-Go Checklist
- Unit logs, Daily Validation or other unit leader documentation
- Press Releases, Public Comments and Complaints
- Smoke dispersal information
- Post fire analysis

- DI-1202 Individual Fire Report (must maintain hardcopy and also enter report into WFMI).
- WFSA if prescribed fire becomes an escaped fire.

g. HISTORIC FUEL TREATMENT MAP

An historic fuel treatment map will be maintained as a hard copy map in the fire management office, along with a log sheet showing the date of each treatment, the number of acres treated, the type of treatment, and the name of the lead person for the project.

h. PRESCRIBED FIRE BURN PLAN

Each prescribed fire must have an approved prescribed fire plan before it may be implemented. The prescribed fire plan is the site-specific implementation document defining the strategic purpose, goals and objectives for the project. All prescribed fire plans must be reviewed and recommended by a Burn Boss qualified at or above the complexity level of the project. The minimum qualifications for the principal person preparing the plan must be a Burn Boss Trainee (RXB2-t), be knowledgeable of the local area, and possess skills for writing the plan. The agency administrator has final authority for the prescribed fire plan and shall ensure the plan receives sufficient oversight, guidance and support. Any amendment that presents major changes to the outcome, size, fire effects or potential impacts on the management organization of the burn shall go through the same review, approval, and notification process as the original plan. The Burn Boss can approve amendments addressing minor changes to specific implementation actions, defined in the Incident Action Plan (IAP) on the day of the burn.

The burn plan must include the following elements:
- Signature Page
- Executive summary
- Description of Prescribed Fire Area
- Goals and Objectives
- Risk Management
- Project Complexity
- Organization
- Cost
- Scheduling
- Preburn Considerations
- Prescription
- Ignition and Holding Actions
- Wildland Fire Transition Plan
- Protection of Sensitive Features
- Public and Firefighter Safety
- Smoke Management
- Interagency Coordination and Public Information
- Monitoring
- Post Fire Rehabilitation
- Post Fire Reports
- Appendices

i. DEBRIS DISPOSAL

All debris disposal activities utilizing fire will be reviewed by the fire management officer or appointed fire staff person. All debris disposal projects requesting the use of fire must be evaluated in terms of alternative

treatments, to determine if such alternatives are feasible and desirable in terms of smoke management and visibility concerns.

If, after consultation with the fire management officer, it is determined that a debris disposal burn will meet all of the following conditions then it may be conducted within debris disposal guidelines.

- Has virtually no chance to exceed the perimeter of the non-wildland environment.
- Will not damage surrounding natural or cultural resources.
- Does not present a safety threat to crew members.
- Will not require curtailment during the burning operation.
- Will not require a prescribed fire burn boss or fire-qualified personnel to implement.
- Requires no follow-up monitoring to evaluate environmental impacts.

Otherwise it will constitute a prescribed fire and must comply with all requirements for that type of activity.

For debris burns, all personnel will wear appropriate personal protective equipment. The supervisor of the burn will notify the fire management office of the need to conduct a burn , so that the fire office may notify the appropriate agencies (air quality, local fire departments, etc.) and neighbors and obtain all needed permits. The supervisor of the burn and the fire management office will jointly develop an appropriate safety and evacuation plan in case of injuries or other emergencies. The crew should include someone who has previously conducted a similar burn at the site or a similar site.

County Fire Marshall's and Fire Chiefs on the Olympic Peninsula have imposed a permanent burn ban on open burning (i.e. pile burns) between the periods of July 1 and October 1, to reduce the risk of human caused fires during the fire season. Although the ban does cover the parks activities, the park will follow this as a guideline for its own debris burning for both park projects and inholders.

D.2. EXCEEDING EXISTING PRESCRIBED FIRE PLAN

Prescribed fire operations might not be fully implemented due to circumstances such as exceeding the prescriptive criteria, adverse fire behavior due to unexpected weather and fire behavior activity, external considerations that direct change to other management alternatives, or movement of the fire outside of the planned burn area.

If prescription parameters are exceeded during project execution, ignition operations should be terminated by the Burn Boss at a safe and appropriate location based on fire behavior, fuels, topography and weather conditions. If the project area comes back into prescription based on current and forecasted weather, ignition operations may continue. If not, the project area is put into a mop-up or patrol status. Holding actions shall maintain control of the fire until a decision to continue, postpone or extinguish the prescribed fire is made and the Agency Administrator or their designee is notified. This decision making process shall be articulated in the prescribed fire plan.

If the prescribed fire exceeds project boundaries and/or slop-over and spot fires are not contained within one burning period, suppression actions will be taken and the entire prescribed fire project will be declared a wildland fire.

If at any time the prescribed fire poses significant threats to life, property, or high value resources, beyond those mitigated in the plan, suppression actions will be taken and the fire will be declared a wildland fire.

Once the prescribed fire is declared a wildland fire all subsequent actions (i.e. operational needs, notifications, strategies, resource orders, etc.) will be defined under a wildland fire transition plan, which is part of the prescribed fire plan until an initial Wildland Fire Situation Analysis (WFSA) is completed.

In these cases, a new strategic alternative will be selected and implemented. The WFSA is the tool to analyze alternatives, identify the appropriate management action, and specify necessary actions.

D.3. AIR QUALITY AND SMOKE MANAGEMENT

See Chapter X Section B.4. AIR RESOURCES

E. NON-FIRE FUEL TREATMENT APPLICATIONS

E.1. HAZARD FUEL REDUCTION

The fuels management program at Olympic National Park includes hazard fuel reduction to provide defensible space around administrative sites, housing and associated structures, historic structures, wildland-urban interface communities, road right-of-ways and pullouts. Up to 200 acres per year will be treated on a cyclic basis, in an effort to maintain lower fuel loads on about 1,000 acres. This includes acres treated by the NPS and by private landowners whose lands are within the boundaries of the park. Over a five-year period, most structures in the park will receive some treatment or maintenance. Hazard fuel reduction methods will include manual/mechanical treatment, followed by pile burning, broadcast burning, chipping, or removal to another site to dispose of the debris.

Areas to be Treated

Approximately 800 ONP and private structures within ONP boundaries may be treated (and re-treated) within this 5-year plan, including about 458 NPS structures. Sites to be treated are located in each fire management unit, with the greatest concentration in the Exclusion Unit. Forty of the NPS structures will be in wilderness, and the maximum area of all treatments located within wilderness will be 50 acres.

The priority is to treat park areas where there are concentrations of structures (in the park or adjacent to the park) intermingled with wildland fuels, such as at Lake Crescent. Sites on the north and east side of the park are of particular concern because of the drier conditions there. Other areas that would be scheduled within this period include occupied structures, historic structures, and structures that can be treated in the course of routine maintenance in the area (e.g. trail crew or patrol ranger working in the vicinity of a backcountry ranger station).

Manual/Mechanical Treatment Methods

Manual treatment is the use of hand-operated power tools and handtools to cut, clear or prune herbaceous and woody species. Occasionally, larger mechanized equipment (a boom truck and front end loader) may be used to move large boles, with the restriction that the equipment is not to be driven off road. Manual/ mechanical treatment is used as a preventative measure to reduce hazard fuels and provide defensible space around administrative sites, housing and associated structures, historic structures, wildland-urban interface communities, and roadways. Thinned fuels will be piled and burned in place, chipped on site, removed to another location (such as a burn pit), or broadcast burned. The method of disposal will depend on the logistics and character of the individual site.

The risk to individual structures will be rated using guidelines adapted from NFPA 299 Standard for Protection of Life and Property from Wildfire (1997). The distance to be treated around each structure will vary from 0 to 250 feet (0 to 76 meters) and will depend on several factors including:

- Size and value of the structure;
- Historic significance;
- Proximity to aquatic resources or important habitat;
- Characteristics of local fuels (height, loading, flammability);
- Wilderness character;
- Visitor use of the area; and
- Proximity to neighboring properties.

Appendix J lists the treatment categories. At each site, the area closest to the structure will receive the most intense fuel reduction with subsequent grading to lighter treatments further from the structure. According to Franklin and Spies (1991), the density of shade-tolerant individual trees larger than 16 inches (40 cm) in groups of at least 10 distinguish old growth from younger stands. Therefore, for the purposes of this plan, trees larger than 16 inches in diameter will be considered components of 'old growth' stands, and will not be cut without specific evaluation by an interdisciplinary team.

Road Right-of-Ways

Road right-of-way maintenance will consist of brushing, mowing, and thinning/cutting of seedlings and saplings, and cutting downed trees from wind throw along road right-of-ways within the park. Treatment will extend no more than 30 from the shoulder (less depending on the roadway). From 20-80 acres of road right-of-ways will be treated per year.

Private Landowners

Private landowners within the boundaries of the park will be encouraged, but not required to do fuel treatment on their own properties. Recent legislation (the Wyden Amendment) and future funding may allow the park to assist with treatment on private property with the agreement of the private landowner in those cases where it is to the benefit of both parties. Private landowners will need to work under current scenic easements, habitat requirements, and an approved fuels management plan.

Project Plan Outline

The non-fire treatment project plan must include the following elements:

- Signature Page
- Executive Summary
- Description of Fuels Treatment Area
- Goals and Objectives
- Cost
- Statement of Work
- Protection of Sensitive Features
- Public and Personnel Safety
- Interagency Coordination and Public Information
- Monitoring
- Post Project Reports
- Appendices

a. ANNUAL PREPARATION

Annual preparation includes finalizing manual/mechanical treatment plans, and updating job hazard analyses.

b. EQUIPMENT AND SEASONAL USE RESTRICTIONS

Large mechanized equipment (e.g., boom trucks and front end loaders) may not be driven off road.

The anticipated timing for manual fuel reduction projects is shown in Appendix K Five-Year Project Plan. Projects may be shifted to another year (depending on availability of funding, severity of fire season, etc.), but the projects are restricted to the months shown in the Five-Year Project Plan.

c. EFFECTS MONITORING

A Fire Monitoring Plan Outline is included in Appendix H. Current NPS monitoring requirements are being rewritten at this time. The fire monitoring plan for Olympic NP will be developed in greater detail during this plans 5-year period and will follow the RM-18 requirements for fire monitoring.

The primary aim of monitoring is to provide information to fire and resource managers which allows them to affirm that treatment objectives (whether prescribed fire, fire use, or non- fire) are being met or to identify and correct deficiencies. Monitoring involves the systematic collection and recording of fuels, vegetation, topography, weather, air quality, and fire behavior data. Fire and resource staff will follow monitoring protocols derived from the National Park Service Fire Monitoring Handbook (FMH), Measuring and Monitoring Plant Populations (Elzinga et al, 1998), and other monitoring systems developed for fire management activities. No Park Service-wide monitoring standards have been established for hazard fuel reduction projects in the wildland-urban interface areas. A variety of monitoring techniques may be used depending on what type of treatment is being conducted and what variables are to be monitored.

For example, if fuel load reduction is of primary concern on a particular project and no FMH plots exist in the project area, only Brown's transects may be installed and monitored to obtain accurate results for this variable. Some areas may be monitored long-term using photo points, instead of vegetation or fuel measurements. Photographs can provide a useful qualitative record of change. Project specific monitoring plans will be developed by fire and resource management personnel with outside help as necessary. In out years this will require providing sufficient lead time for inclusion of monitoring in annual work plans. Monitoring is an integral part of doing projects and funding for the monitoring must be included in project budgets. Fuel treatment goals, monitoring goals, and specific monitoring protocols will be identified in the project plan. All documentation will be stored in the project folder and kept in the fire management office.

d. CRITIQUES OF MANUAL/MECHANICAL TREATMENT PROJECTS

Annual unit level reviews will occur when fuels management activities have been undertaken in the previous year or are planned for current or future years. The Fuels Management Specialist is responsible for conducting these reviews. They may be conducted during the yearly fire plan review. Project originators (e.g. Natural or Cultural Resource management specialists) shall be involved in the review process.

e. COST ACCOUNTING

Project plans must include estimated total costs for all phases of the project. Following completion of each project, the actual costs will be documented in project accomplishment reports.

f. REQUIRED REPORTS AND DOCUMENTATION

All hazard fuel projects will be documented with the following information and stored in an individual project folder and maintained in the park's fire management files.

- Original Signed Project Plan
- All Maps
- Notification Checklist
- Permits
- Monitoring data
- Unit logs or other unit leader documentation
- Contracts

g. ANNUAL PROJECT LIST

See Appendix K: Five-Year Project Plan.

F. EMERGENCY REHABILITATION AND RESTORATION

Once the fire is out, rehabilitation of constructed firelines to their natural state becomes the next priority. Generally, there will be no rehabilitation of the actual fire area. The only exception may be the reseeding of naturally occurring grasses to prevent serious erosion, if deemed necessary, on human-caused fires. If re-vegetation or seeding is required, only native plant species will be utilized and the Resource Management staff will be consulted on which native plant species will be utilized. Approval to re-vegetate or re-seed requires the prior written approval of the Regional Director, as per DO-18. Rehabilitation will not be performed on fires for ecological benefit, except to rehabilitate backcountry trail areas or along fireline that may have been constructed to contain a flank of the fire. When suppression action is taken, rehabilitation is appropriate on those areas where the suppression action took place. If extensive rehabilitation is required, the Department of Interiors Burned Area Emergency Rehabilitation Handbook (BAER) is available as a guidance tool.

The most effective rehabilitation measure is prevention of impacts through careful planning and the use of minimum impact tactics.

Rehabilitation plans for each fire will be jointly formulated and initiated by the Fire Management Officer, the Incident Commander and the appropriate park resource advisor(s) and staff, both natural and cultural. Rehabilitation will be directed toward minimizing or eliminating the effects of the suppression effort on vegetation, trails and the control of unwanted exotics from encroaching upon the site. Rehabilitation activities may require Section 7 consultation with USFWS for T&E species. The assigned resource management advisor(s) will determine the need for consultation. Rehabilitation will be started prior to complete demobilization of resources.

Typical rehabilitation measures include:
- Backfill deep and wide control lines and scarify.
- Install water bars and construct drain dips on control lines to prevent erosion.
- Flush cut stumps and camouflage with soil and moss.
- Place "boneyard" materials in random or natural positions.
- Position felled and bucked material so as to be least noticeable to visitors and camouflage where possible.
- Restore natural ground contours.
- Remove all flagging, equipment and litter.

- Completely restore camping areas and improved helispots.
- Consider and plan more extensive rehabilitation or revegetation to restore sensitive impacted areas.

If rehabilitation efforts will greatly exceed the park staff's capabilities, the National Park Service can utilize one of the BAER (Burned Area Emergency Rehabilitation) Teams. These teams are designed to come into an area that has suffered a fire and assist the unit in writing and implementing a fire rehabilitation plan. This can greatly relieve the stresses associated during a large fire situation. The BAER team consists of a team leader, Forester, Hydrologist, Soils/Geology Specialist, Wildlife Specialist, Compliance and Documentation Specialist, Vegetation Specialist, Watershed Specialist, and a Fire Behavior Specialist. It is recommended that a fisheries biologist be added to this team for large fires in the park. The BAER teams are located within the Pacific West Region and are ordered through normal fire dispatch channels.

Cultural Resource Management (CRM) staff will determine if cultural resources were damaged by the fire event or associated suppression actions, and if key cultural sites are likely to be damaged by fire related catastrophic soil movement. The CRM staff will assure that rehab actions do not damage cultural resources.

CHAPTER V
Fire Management Organization and Responsibilities

A. FIRE MANAGEMENT ORGANIZATIONAL STRUCTURE

The Fire Management Officer supervises a permanent, full-time Prescribed Fire Specialist, a subject-to-furlough Lead Forestry Technician, a permanent, full-time Fire Program Assistant, and the seasonal staff for two Type 6 engines. The Prescribed Fire Specialist supervises the seasonal Hazard Fuel Reduction crew that works on projects at Olympic National Park and San Juan Island National Historic Park. The Hazard Fuel Reduction Crew varies in size depending on the projects that have been funded. A portion of the crew or the whole crew may be contracted through the Student Conservation Association or other contractors. The Lead Forestry Technician supervises the seasonal personnel assigned to a Type 3 engine based at Headquarters.

All of the fire staff is based out of the Headquarters office, except the staff for the two Type 6 engines – one of which is stationed at Kalaloch, and one at Lake Crescent.

B. FIREPRO FUNDING

Olympic National Park receives funding as a FIREPRO funded park. Under a FIREPRO analysis, the National Fire Office will determine the appropriate funding level to allow for adequate suppression resources to manage wildland fire incidents in a normal fire year at Olympic. During the life of this plan, the firepro analysis system will be replaced by the FPA (Fire Program Analysis) system. The FPA system will be utilized to determine fire presuppression funding levels by all Federal land management agencies beginning in 2008.

Fuels projects are funded under the NFPORs system, which is a national program designed for wildland fuels management projects. Projects are individually identified, compiled as part of a five year plan and submitted to region for recommendation of funding. If funded, the park will be allocated the asked for funds and crews or contractors will be hired to accomplish the project.

The Fuels Management Specialist or Fire Management Officer will serve as the Contracting Officer's Representative (COR) for any contract crews that may be funded to complete fuels management work.

C. PARK ORGANIZATIONAL STRUCTURE

C.1. ORGANIZATION

The park staff includes approximately 140 permanent positions and 180 seasonal positions. More than half of the park employees are based out of the Headquarters complex in Port Angeles, with the rest of the staff distributed among the various districts and sub-districts. Some areas are not staffed in the winter months.

The agency administrator for the park is the Superintendent. The park Superintendent supervises the Deputy Superintendent, Public Affairs Specialist, Fisheries Biologist (Management), Environmental Protection Specialist, GIS Specialist, and a Secretary. The Deputy Superintendent supervises the Occupational Health and Safety Manager, Concessions Specialist, and six division chiefs (Division of Administration, the Division of Natural Resources, Division of Resource Management and Visitor Services; Division of Cultural Resources, Division of Resource Education, and Division of Maintenance).

The Chief Ranger, responsible for the Division of Resource Protection & Visitor Use Management, supervises the Assistant Chief Ranger, Revenue & Fee Business Manager, Administrative Assistant, and Fire Management Officer. The Assistant Chief Ranger supervises the Legal Assistant, two Criminal Investigators, a Supervisory Communications Operator, four Ranger District Rangers and one Wilderness Information Center (WIC) Ranger.

C.2. RESPONSIBILITIES

Superintendent

The Superintendent has the ultimate responsibility for fire management in Olympic National Park, with the Deputy Superintendent being delegated authority over all field operational aspects of the park. The Deputy Superintendent has delegated primary authority for all fire operational activities to the Chief Ranger.

The Superintendent (or other delegated individual) is responsible for approving the Wildland Fire Implementation Plan (WFIP), including the initial Decision Criteria Checklist, the Periodic Fire Assessments and any revisions of the WFIP.

The Superintendent (or other delegated individual) is also responsible for approving the Wildland Fire Situation Analysis (WFSA).

The Superintendent functions as the Agency Administrator on prescribed fire and retains the ultimate authority for approving all such fires. Responsibilities include:

- Ensure that every wildland firefighter, fireline supervisor and fire manager takes positive action to obtain compliance with established standards and safe practices.
- Ensure that the prescribed fire plan is closely linked to and consistent with the fire management plan and Agency direction and policy.
- Ensure that all prescribed fires, non-fire treatments and debris disposal are conducted in accordance to established standards and guidelines.
- Ensure that all escaped prescribed fires that result in resource or property damage are reviewed and investigated.

The Superintendent will declare any park closures, as needed. The Superintendent is responsible for issuing the written delegation of authority, in the event that an Interagency Incident or Fire Use Team is assigned to a fire at Olympic.

The Chief Ranger

The Deputy Superintendent has delegated primary authority for all fire operational activities to the Chief Ranger. Authority for routine fire program management, coordination of all fire management activities, emergency mobilization and dispatch is delegated from the Chief Ranger to the Fire Management Officer (FMO).

The Chief Ranger ensures that a comprehensive fire management program at Olympic NP is adequately planned for and implemented. The Chief Ranger will also evaluate fire activity in terms of public and employee safety and make recommendations for closures. The Chief Ranger designs and implements the park evacuation plan, at the discretion of the Superintendent. The Chief Ranger delegates the day-to-day supervision of District Rangers to the Assistant Chief Ranger. The District Rangers report directly to the Assistant Chief Ranger. They are responsible to the Chief Ranger and FMO for the proper implementation of this plan in their areas. Although the Ranger Division has overall responsibility for management of the fire program, its continued success requires the cooperative effort of all divisions.

Fire Management Officer (FMO)

Authority for routine fire program management, coordination of all fire management activities, emergency mobilization and dispatch is delegated from the Chief Ranger to the Fire Management Officer (FMO).

The FMO coordinates with all park divisions and with cooperating agencies in the development and execution of project level implementation plans.

The FMO ensures that a Wildland Fire Implementation Plan (WFIP) is completed to the extent necessary for each wildland fire or complex of fires. The stage of the WFIP that needs to be completed will depend on the status of the fire and whether it is to be suppressed or utilized for resources benefit.

The FMO ensures that a Wildland Fire Situation Analysis (WFSA) is completed for each unsuccessful action on wildland fires. When developing the WFIP and WFSA, the FMO will consult with the division chiefs or their designees regarding the potential effects of contemplated actions on park resources. The WFIP and WFSA will be documented by the FMO and submitted through the Chief Ranger, to the Superintendent for approval.

The FMO ensures that each wildland fire use and suppression action is staffed with fully qualified personnel, including a fully qualified Incident Commander (IC) or Prescribed Fire Burn Boss or Fire Use Manager for the appropriate size and complexity of the fire(s). The FMO, if qualified, may serve as the IC or s/he may designate a qualified IC who serves under the oversight of the FMO.

The FMO coordinates with the Public Information Officer and Resource Educators to ensure accurate and timely output of information to the public, and to park employees.

The FMO is also responsible for requesting appropriate accounts and tracking costs for wildland fire use and suppression incidents.

Natural Resources Division

The division will support wildland fire use and fire suppression by providing natural resource management expertise, personnel and equipment. The Natural Resource Management Division will assist with Section 7 consultation requirements concerning impacts on endangered or threatened species, and air quality issues, and will assist in the development of the WFIP and WFSA. The Natural Resource Management staff may provide resource advisors for assignment to wildland fires. A natural resource advisor will be requested for all fires class C or larger (10 acres or larger). Resource advisors may be assigned for smaller sized fires, dependent upon location of the fire and potential impacts to species or resources of concern. Staff personnel will assist in developing post-fire rehabilitation projects, to aid in determining impacts of fire management activities.

The Resource Management Specialists are responsible to the Agency Administrator for ensuring the fuels management program is planned and implemented in a manner supporting the park's resource management goals and objectives. Responsibilities include:

- Ensure resource management representation in the preparation of the prescribed fire and non-fire treatment plan.
- Ensure a Divisional review of prescribed fire plans is conducted before each plan is submitted for approval.

- Evaluate fire use and non-fire treatment projects in terms of meeting objectives and operational efficiency.

Cultural Resources Division

The division will support wildland fire use and fire suppression activities by providing cultural resource management expertise, personnel and equipment. This division will assist with the determination of threats or impacts to cultural resources during fire management activities. This division will serve as the park liaison with local Native American tribes to determine potential impacts to cultural areas. Cultural resource management staff will be consulted in the following situations:

- The fire is in the vicinity of known cultural sites.
- The fire is located in a sensitive location that has a high probability of having been used in prehistoric times. Sensitive locations include ridges, saddles, mountain lakes and meadows.
- The fire is 10 acres or larger (size class C or larger).
- Firefighters are engaged in activities that have potential for disturbing sensitive sites. These activities include improvement of helispots, safety zones, spike camps and escape routes, and/or use of these areas for more than 48 hours.

Maintenance Division

This division will assist in wildland fire use and fire suppression by providing personnel, equipment and supplies, as needed.

Administrative Division

This division will assist in fiscal management and may provide personnel for timekeeping, procurement and property management, or in other qualified positions.

Resource Education Division

The Resource Education Division provides information and interpretation to visitors regarding the natural role of fire and the park's efforts to restore natural fire to park ecosystems. (Note: this information will not be mixed with information on the status of wildland fire suppression.)

The Resource Education Division will also provide personnel for wildland fire use and fire suppression duties.

Public Information Officer

The Public Information Officer will prepare press releases and make contact with public media regarding high fire danger; fire restrictions; wildland fire use actions; fire suppression; or other fire management activities of note. (Note: information regarding the natural role of fire, and the park's efforts to restore natural fire to park ecosystems will not be mixed with information on the status of wildland fire suppression.)

GIS Branch

The GIS branch will assist the fire management office by providing maps, GIS data and general mapping support of wildland fire use and suppression fires. This branch will also provide Global Positioning System (GPS) expertise to document helicopter flight paths and fire perimeters.

Incident Personnel

All wildland fires will be managed under the incident command system (ICS) under the immediate direction of a qualified Incident Commander (IC) or Prescribed Burn Boss or Prescribed Fire Manager (PFM), of the appropriate level for the incident. The IC/Burn Boss/PFM manages all assigned resources, whether monitoring or suppression, implements the selected strategy from the WFIP or WFSA, and collects data to permit update of the analysis as necessary.

During all wildland fire use and suppression actions there will be a qualified Incident Commander Type III pre-designated and available to respond in the event that the complexity escalates or the fire escapes.

Operational positions which will be required to manage a wildland fire use action will be specified in the WFIP . These may include positions such as overhead, firing, holding, monitoring, resource advisors, backup, etc. Appropriate skill levels are guided by the NPS complexity analysis. Fire Use Management Teams (FUMT) or Incident Management Teams (Type 1 or 2) can augment wildland fire use, when exceeding local capabilities.

It is recommended that a Long Term Fire Behavior Analyst (LTAN) be assigned or consulted during the development of the WFIP - Stage III to provide a complete review of Maximum Manageable Areas and Wildland Fire Implementation, provide input regarding the potential of fire, assess potential risk, and make extended fire behavior predictions for comparisons of documented and/or potential fire behavior.

All wildland fire use actions will be monitored. It is recommended that qualified Fire Effects Monitors (FEMO) and Weather Observers (WOBS) be ordered to staff fires as needed.

Qualified Individuals

Olympic National Park fire personnel and qualifications are listed in Appendix T: Park Organization. Personnel qualifications and training will be maintained on the National Park Service Wildland Fire Management Computer System (IQCS).

D. SIGNATURE AUTHORITY

The park Superintendent is responsible to periodically assess and certify by signature that continued management of wildland fire use actions is acceptable. The park superintendent under certain conditions may delegate this responsibility to another organizational level.

E. INTERAGENCY COORDINATION

Olympic National Park cooperates extensively with the surrounding agencies, including Olympic National Forest, the State of Washington Department of Natural Resources, local fire districts, the Puget Sound Interagency Coordination Center, the Olympic Peninsula Agency BIA, the Quinault Indian Nation and the Hoh, Makah, and Quileute Tribes in training, prevention, detection and suppression activities. These cooperative relationships are fundamental to the success of the fire program and must continue to receive emphasis to insure that all contingency plans are jointly developed.

Olympic National Park personnel are usually used for initial attack of fires within or adjoining the boundaries of the park. If assistance is required, it is requested from adjacent cooperators under memorandums of agreement. The "closest forces concept" shall be utilized whenever possible. In some cases, cooperating agency crews will suppress small fires close to or straddling the boundary or which threaten adjacent lands.

Likewise, park personnel occasionally suppress fires on forest, state and private lands. Any initial attack of a fire on another agency's lands will include prompt communication with the agency, to insure that proper management activities are taking place. Park fires that escape initial attack will be managed by an incident management team. The incident management team may consist of the park's own overhead resources for smaller fires, or an interagency incident management team for larger fires.

Olympic National Park may enter into cooperative agreements or memoranda of understandings to jointly furnish crews for wildland fire engines, incident management teams, or hand crews, with the Olympic National Forest, the Washington State Department of Natural Resources, U.S. Fish and Wildlife Service, Bureau of Indian Affairs and Tribes/Indian Nations. Joint expanded dispatch centers may be established when the Olympic Peninsula is experiencing multiple fires. The park will continue to work with other agencies to improve efficiency and reduce costs of the fire agencies.

The Fire Management Officer is responsible for insuring that cooperative agreements and memoranda of understandings are reviewed annually, updated as necessary and will schedule preseason meetings with cooperators as required.

F. KEY INTERAGENCY CONTACTS

Bureau of Indian Affairs, Olympic Peninsula Agency
Bureau of Indian Affairs, Puget Sound Agency
Clallam County Sheriff's Office: PENCOM
NW Indian Fisheries Commission: Information Officer
Olympic Coast National Marine Sanctuary: Manager
Olympic National Forest: Forest Supervisor
Olympic National Forest: Fire Staff
Olympic National Forest: Public Information Officer
Olympic National Forest, Pacific Ranger District: Fire Management Officer
Olympic National Forest, Hood Canal Ranger District: Fire Management Officer
Port Angeles Fire Department: Fire Chief
Puget Sound Interagency Communication Center
State of Washington Department of Ecology
State of Washington Department of Natural Resources- Olympic Region:
State of Washington Department of Natural Resources
State of Washington Department of Parks and Recreation Commission: Director
State of Washington Department of Trade & Economic Development: Tourism Development Division
US Army/Ft Lewis Forestry
US Army/Ft Lewis Forestry
U.S. Coast Guard Station Air Station, Port Angeles
U.S. Coast Guard Station, Quillayute River
U.S. Fish and Wildlife Service, Dungeness Wildlife Refuge
Western Washington Interagency Training Committee

Tribes/Nations
Hoh Tribe
Jamestown S'Klallam Tribal Council
Lower Elwha S'Klallam Tribal Council
Makah Tribal Council
Port Gamble S'Klallam Tribe
Puget Sound Agency

Quileute Tribal Council
Quinault Indian Nation
Skokomish Tribal Council
Suquamish Tribal Council

Fire Departments / Fire Districts
Clallam Fire District #2
Clallam Fire District #3
Clallam Fire District #4
Clallam Fire District #5
Clallam Fire District #6
Grays Harbor Fire District #4
Jefferson County Fire District #4
Jefferson County Fire District #7
Mason County Fire District #1
Mason County Fire District #18
Port Angeles Fire Department

Offices of Emergency Management
Clallam County Emergency Management
Jefferson County Emergency Management
Mason County Emergency Management
Grays Harbor Emergency management

U.S. Legislature
- Representative in Congress, 6th Congressional District: (Norm Dicks)
- Senator (Maria Cantwell)
- Senator (Patty Murray)

State Legislature
- District 24 Senator (Jim Hargrove)
- District 35 Senator (Tim Sheldon)
- District 24 Representative (James Buck)
- District 24 Representative (Lynn Kessler)
- District 35 Representative (Kathy Haigh)
- District 35 Representative (William Eickmeyer)

G. FIRE RELATED AGREEMENTS

National Agreements

The Interagency Agreement for Fire Management (F00001-03-0011) is a national level agreement between the BLM, BIA, NPS, USFWS, and USFS. It was established to provide a basis for cooperation between the agencies on all aspects of wildland fire management and as authorized in non-fire emergencies; and to facilitate the exchange of personnel, equipment, supplies, services, and funds between the agencies. This agreement is in effect until September 30, 2008.

The Memorandum of Understanding for the Development of a Collaborative Fuels Treatment Program is a national level agreement between the BLM, NPS, USFWS, USFS, National Association of State Foresters, and the National Association of Counties. It was established to provide a framework of a process to

collaborate on the annual selection of a fuels treatment program of work within their respective jurisdictions to provide for community protection and enhance the health of forests and rangelands.

The Umbrella Agreement between the National Park Service and the Student Conservation Association, Inc. (H0001020002) is a national level agreement that allows individual park units to obligate park monies to fund SCA interns and conservation work crews. The agreement is in effect until September 30, 2006.

Regional and Sub-Geographic Agreements

The Puget Sound Interagency Coordination Center Operations Plan is tiered off of the sub-geographic agreement that establishes and facilitates the operation of the Puget Sound Interagency Communication Center. The agreement also establishes guidelines covering present and future operations of the Center which will ensure cost effective utilization of agency emergency response resources with the intent to maximize coordination and assistance among the agencies involved and their cooperators. A draft annual operating plan is developed by October 1 each year and a final operating plan is approved by April 1 each year. The annual operating plan defines the extent and nature of the operations coordinated by PSICC. The FMO for Olympic National Park is a member of the Operations Committee.

The Master Cooperative Fire Protection Agreement (H8075040099) between the northwest regions of the BLM, NPS, BIA, USFWS, USFS, and the States of Washington and Oregon is a regional agreement. It documents the commitment of the parties to the agreement to improve efficiency by facilitating the exchange of personnel, equipment, supplies, services, and funds among the agencies. This agreement was established in 1998, and remains in effect for five years. A review of the agreement will be conducted every five years for appropriateness and modified or renewed for a period of five years. The review and revision of this agreement is handled at the regional level, with input from local units. As of April 2003, updates to the Master Agreement and Operating Plan were in progress.

Local Agreements

Memorandum of Understanding, Master Mutual Aid Agreement For the Provision of Emergency Services to the Areas of Eastern Clallam County is a local agreement between the park and the Port Angeles Fire Department, Clallam County Fire District #2, Clallam County Fire District #4, Clallam County Fire District #4, and State of Washington Department of Natural Resources. The parties to this agreement agree to render each other the maximum cooperation possible in the sharing of personnel, equipment, and technical expertise in order to deal with large fires, conflagrations, military attack, hazardous materials incidents, or other disasters. The agreement is being updated as of the writing of this plan.

Task Agreement No. WWU-01-2 to Cooperative and Joint Venture Agreement No. CA9088A0008 with the Cooperative Ecosystem Studies Unit (Western Washington University). The purpose of this research project is to evaluate the soil properties and vegetation distributions in and around Ahlstrom's and Roose's Prairies, Ozette region of Olympic National Park, in order to identify their origin, changes in size through time, and the relationship between soil, vegetation, and land-use (specifically burning).

Cooperative Agreement No. H9500020043 between the Department of the Interior, National Park Service, Olympic National Park and Regents of the University of California, Davis Campus. The purpose of this research project is to reconstruct historical land use and vegetation patterns of the Ozette Prairies, Olympic National Park through ethno biological research.

Proposed Agreement: Olympic National Park and Olympic National Forest (OLF) manage adjoining wilderness areas on the east and southeast side of the Olympic Peninsula. The Conditional Unit has been established along these boundaries to facilitate joint management of wildland fire used for resources benefit

across the boundaries. OLF is not able to enter into an agreement to allow joint management of fires until it has completed its Fire Management Plan. Once the forest has completed its Fire Management Plan, it is the intent of the park to continue with negotiations for this type of agreement.

Copies of sub-geographic and local agreements are located in Appendix I.

CHAPTER VI
Monitoring

A. SHORT AND LONG TERM PROGRAMS

All units implementing fire use activities must develop short and long term monitoring programs to assess accomplishments and to determine effects of management activities on cultural and natural resources.

The primary aim of monitoring is to provide information to fire and resource managers, which allows them to affirm that treatment objectives (whether prescribed fire, fire use, or non- fire) are being met or to identify and correct deficiencies. Monitoring involves the systematic collection and recording of fuels, vegetation, topography, weather, air quality, and fire behavior data. Fire and resource staff will follow monitoring protocols derived from the National Park Service Fire Monitoring Handbook (FMH), Measuring and Monitoring Plant Populations (Elzinga et al, 1998), and other monitoring systems developed for fire management activities. A variety of monitoring techniques may be used depending on what type of treatment is being conducted and what variables are to be monitored.

For example, if fuel load reduction is of primary concern on a particular project and no FMH plots exist in the project area, only Brown's transects may be installed and monitored to obtain accurate results for this variable. Some areas may be monitored long-term using photo points, instead of vegetation or fuel measurements. Photographs can provide a useful qualitative record of change. Project specific monitoring plans will be developed by fire and resource management personnel with outside help as necessary. In out years this will require providing sufficient lead time for inclusion of monitoring in annual work plans. Monitoring is an integral part of doing projects and funding for the monitoring must be included in project budgets.

The FMH identifies four levels of monitoring:

Level 1 – Environmental	Weather; Fire Danger Rating Fuel Conditions; Resource Availability; Concerns and Values to be Protected; Other Biological, Geographical or Sociological Data
Level 2 – Fire Observation	Stage I: Reconnaissance - Fire cause; location, size, logistical information, fuel and vegetation types, current and predicted fire behavior, potential for spread, current and forecasted weather, resource or safety threats and constraints, and smoke volume and movement. Stage II: Fire Conditions – Topographic variables, ambient conditions, fuel model(s), fire characteristics, and smoke characteristics, holding options, resource advisor concerns.
Level 3 – Short-term Change	Fuel reduction, vegetative change or other objective dependent variables with in 1 to 5 years after a burn.
Level 4 – Long-term Change	Continued monitoring of Level 3 variables to measure trends and change over time

Fire management activities will be monitored at the appropriate level in relation to the type and scale of each project.

B. NPS FIRE MONITORING HANDBOOK

The National Park Service Fire Monitoring Handbook (FMH) is recommended as a source document providing monitoring procedures that meet NPS needs. Monitoring protocols must be reviewed and approved at the regional office level before receiving funding.

C. FIRE MONITORING PLAN

See Appendix H: Fire Monitoring Plan Outline. This is a preliminary fire monitoring plan for Olympic National Park. It summarizes four levels of fire monitoring that are described in more detail in the National Park Service Fire Monitoring Handbook. During this five-year period, the park's fire monitoring plan (especially sections related to non-fire fuel treatments) will be developed further by fire management and resource management staff, utilizing expertise within the park, within the NPS, and other agencies.

CHAPTER VII
Fire Research

A. PREVIOUS FIRE RESEARCH

Agee, J.K., and Flewelling, R. (1983). A fire cycle model based on climate for the Olympic Mountains, Washington. Fire and Forest Meteorology Conference Proceedings, 7, 32-37.
In this study a modeling approach was employed to determine fire rotations. The objectives of the model were to simulate modern lightning fire activity using modern climatic and fire information, and once verified, to use the model to interpret past fire within the park. A Monte Carlo type model was applied to seven different situations on the east and west sides of the park, as well as parkwide. Situations included: with and without fire suppression, increased probability of drought, thunderstorms, or east winds, and combinations of the above. Fire cycles calculated by the model exceeded 1000 years except when the model was run with increased drought (east-side) or increased drought plus east wind (east-side and whole park). The parkwide model (with no adjustments to historic weather) provided a closer estimate of the actual (1916-1981) fire cycle (77 percent) than the westside (65 percent) or eastside (130 percent) models. Model validation was only partially possible, because there is no independent data set available for this site-specific model. Additionally, the actual fire data set is so small compared to the length of the fire cycle (60 vs. 7000 years) that only 1 percent of the estimated fire cycle is available for model validation.

Agee, J. K., and Huff, M. H. (1980). First Year Ecological Effects of the Hoh Fire, Olympic Mountains, Washington. Proceedings of the Sixth Meteorology Conference, pp.175-181. Seattle, Washington.
This study examined 1) the relative fire intensities over the burned area of the Hoh Fire; 2) whether fire or other disturbances were unusual in this area; and 3) what effect the fire had on forest structure and subsequent regeneration. Methods included aerial photography and mapping; an extensive study of forest age; and measurement of vegetation, fuel characteristics and regeneration on burned and unburned plots in the study area. It was found that the Hoh Fire burned primarily in the montane zone, with a smaller portion in the subalpine zone. Roughly equal portions of unburned/bare area occurred in those zones, however, over half of the subalpine area (dominated by Pacific silver fir and mountain hemlock) burned as a crown fire, while less than 10 percent of the montane area (dominated by western hemlock and Douglas-fir) crowned out. Topographic influences in combination with fuel and weather were responsible for most of the unburned islands and the general shape of the fire. The fire boundary was often coincident with subtle or abrupt changes in forest type. A variety of disturbance factors, including fire, played a major role in defining the structure and composition of the forest. Past disturbances were estimated to have occurred around 1514, 1488, and 1473 (all periods of first or second degree droughts). Measurements on the 1978 fire indicated that burned plots had fewer but larger stems than unburned plots. The fire exaggerated pre-fire differences in forest density. One-year after the fire, regeneration was poor in subalpine areas but abundant in montane areas.

Agee, J. K., and Huff, M. H. (1987). Fuel succession in a western hemlock/Douglas-fir forest. Canadian Journal of Forest Research, 17(7), 697-704.
Fuel succession was quantified for a 515-year chronosequence in a *Tsuga heterophylla/Pseudotsuga menziesii* forest. Postfire stand ages selected were 1,3,19,110, 181, and 515. After initial reductions due to mortality from fire in the first 3 years, live above-ground biomass in the tree component increased over time to over 1100t/ha. Shrub and herb layer biomass was highest in year 19 and year 515. Dead above-ground biomass had different trends for different fuel size classes; normalized fuel loadings of five dead and down fuel categories peaked at four different stand ages: 1-h and 10-h timelag (TL) fuels, age 1; 100-

h TL fuels, age 19; 1000-h TL fuels, age 110; >1000-h TL fuels, age 515. Surface fire behavior was highest early in the sere and lowest at ages 110-181. Old growth forest patches appear to be best buffered against forest fire by mature forest patches rather than old growth or recently burned natural stands.

Agee, J. K., Huff, M. H., Smith, L. and Scott, D. R. M. (1980). Ecological Effects of the Hoh Fire, Olympic National Park, 1979 Annual Report for National Park Service Contract CX-9000-9-0057. College of Forest Resources, University of Washington. Seattle, Washington.
In August 1978, the Hoh Fire burned more than 1000 acres in Olympic National Park. The effects of this fire were studied to provide input to the development of the fire management plan. The first annual report for this three-year study contains six major sections. The report begins with a discussion of characteristics of significant past fires on the Olympic Peninsula, which leads into a detailed discussion of characteristics of the Hoh Fire. The recent disturbance history of the Hoh Fire vicinity is explored, indicating that fire is one of several recurring disturbances in the area. The montane ecological studies, both of a reconnaissance and permanent plot nature, are discussed next, and include vegetation and animal research. Forest regeneration in both montane and subalpine areas is the next subject. The last study topic is the tree invasion of subalpine areas burned in 1891, 1924, and in 1978. The report concludes with a study plan for 1980, which summarizes proposed activities for the coming season.

Agee, J. K., Huff, M. H., Smith, L. and Scott, D. R. M. (1981). Ecological Effects of the Hoh Fire, Olympic National Park, 1980 Annual Report for National Park Service Contract CX-9000-9-0079. College of Forest Resources, University of Washington. Seattle, Washington.
This was the second year of a three-year study on the effects of the 1978 Hoh Fire. The second year of study emphasized expansion of the establishment of a permanent plot baseline, and study of avifaunal impacts. Two published papers based on data from the first year of study are attached as an appendix to the second annual report. (See Josephson abstracts, below.)

Agee, J. K., and Scott, D. R. M. (1983). Ecological Effects of the Hoh Fire, Olympic National Park. National Park, Final Report for National Park Service Contract CX-9000-9-E079. College of Forest Resources, University of Washington. Seattle, Washington.
The final report for the three-year study of the effects of the Hoh Fire includes an introductory summary section and three technical completion reports. Much of the information in the technical completion reports is also presented in subsequent published articles. See abstracts of work done by Agee, Huff and Smith, below.

Agee, J. K., and Smith, L. (1984). Subalpine Tree Reestablishment after Fire in the Olympic Mountains, Washington. Ecology, 65(3), 810-819.
Rates of subalpine tree reestablishment were measured on the 1978 Hoh burn (3 yr old), the 1924 Mount Wilder burn (55 yr old), and the 1891 High Divide burn (88 yr old) in Olympic National Park, Washington, USA. All three sites were *Abies lasiocarpa/Tsuga mertensiana* forest at the time of burning; *Vaccinium spp*. were dominant after the fire. Tree establishment rates were higher than during below average periods. Highest rates of tree establishment occurred close to fire edges. Drought resistance of the residual tree species may interact with climate to affect establishment rates. *Tsuga mertensiana* established best during wet periods*; Abies lasiocarpa, Pseudotwsuga menziesii, and Pinus monitcola* establish well during normal periods. These patterns are quite different from tree invasion into heather (*Phyllodoce/Cassiope*) meadows, which occurred during a fairly discrete 1920-1940 regional drought when extended snow-free periods apparently existed in these meadows.

Fahnestock, G.R., and Age, J.K. (1983) Biomass Consumption and Smoke Production By Prehistoric and Modern Forest Fires In Western Washington. Journal of Forestry 81(10), 653-657.

Wild and prescribed fires currently burn about 20,100 ha per year in Washington west of the Cascade Crest; prehistoric wildfires burned an estimated 19,200 ha per year. Modern burning consumes 38 $g/m^2/yr$ of fuel; the estimated prehistoric rate was 35 $g/m^2/yr$ over a 50-percent larger forestland base. Total fuel consumption and smoke production from forestland therefore have declined by about 22 percent. Impairment of visibility in prehistoric times by forest fire smoke was probably slight except during infrequent major fires. Today visibility is slightly to moderately impaired more often, but smoke palls of prehistoric magnitude are unlikely to occur. The ability to compare prehistoric and modern conditions should facilitate air quality planning and management.

Fonda, R.W., L.A. Belanger, and Burley, L.L. (1998) Burning Characteristics of Western Conifer Needles. Northwest Science 72(1), 1-9.
The needles from thirteen species of western conifers were burned to compare flammability of non-woody fuels. (The samples of lodgepole pine were collected in the Deer Park area of Olympic National Park.) The following burning characteristics were measured in a completely randomized design ANOVA: maximum flame height, flame time, ember time, burn time, percent combusted, and mean rate of weight loss. The burning characteristics tested in this study address important aspects of nonwoody fuel flammability in coniferous forests. Ponderosa pine, Jeffrey pine, Monterey pine, coast redwood, knobcone pine, giant sequoia, and sugar pine ranked in the upper half of most burn categories. These highly flammable species are prominent in communities for which fire return intervals are two to four decades. Lodgepole pine, western redcedar, Douglas-fir, Pacific silver fir, subalpine fir, and western hemlock seldom ranked in the upper half of any of the burn categories. The needles of these species are less flammable than the upper group of seven. The fire return intervals for the communities in which they grow are commonly two or more centuries.

Gracz, M. B. (1989). Reestablishment of Abies lasiocarpa After Fire in the Pacific Northwest. Thesis (M.S.), University of Washington. Seattle. 83 pp.
The early phase of *Abies lasiocarpa* reestablishment after fire in the Pacific Northwest region was examined. A lag time of about 50 years between fire and a period of rapid establishment has been partially attributed to the dynamics of down log accumulations. Snags fall about 50 years after the fire and may be necessary for seedling establishment. A seedling/substrate experiment was conducted to examine which substrates commonly available after fire produced the best seed germination and seedling survival. The effect of two moisture regimes was also tested. The fieldwork was conducted at Olympic National Park (Lost Basin Fire, Mount Claywood Fire, and Eagle Point), Crystal Mountain, and North Cascades National Park Service Complex. Seedlings survive best on bare mineral soil. No substrate x moisture interaction was observed; all substrates with the wetter moisture regime produced more seedlings than the substrates with the drier treatment. A small tree/moderator study was conducted in the field to investigate small tree associations with objects that could provide mitigation of temperature and moisture extremes. The effect of logs in providing microenvironmental moderation was further examined using a regression model that tested the relationship between sapling density and log cover on six recently burned subalpine sites. The most common objects that small trees were associated with were logs, trees and shrubs. Small trees were most consistently associated with logs across sites, but site variation was present. Log cover did not predict sapling density on the recently burned sites. This suggests that although logs are generally important as microsite moderators, they are probably not responsible for the lag time observed between year of burn and later periods of rapid tree reestablishment.

Huff, M.H. (1995). Forest age structure and development following wildfires in the western Olympic Mountains, Washington. Ecological Applications, 5(2), 471-483.
Fire is an important disturbance agent influencing forest composition and structure in Pacific Northwest ecosystems. Huff examined the effects of long fire-return interval on forest development, composition and age structure for a post-fire sere on the west slope of the moist Olympic Mountains. Similar sites that burned in 1978, 1961, 1870, 1799, and circa 1465 were selected. Tree cores and size characteristics were collected

from two randomly located 0.25-ha plots at each site. Fires usually burned catastrophically, killing most overstory vegetation. Pioneer tree species were Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*); western hemlock assumed dominance early in the sere. Forest reestablishment after fire was slow, taking ≥50 yr to complete establishment of shade-intolerant Douglas-fir. Understory establishment of western hemlock increased 150 yr after fire, although conditions that enhance its long-term survival may occur ≈300 yr or more after fire. Establishment of western hemlocks existent at the 1465 fire site peaked ≈365-424 yr after the fire; individuals establishing 150-300 yr after the fire occurred much less frequently. Fire exclusion would shift the replacement sequence toward a wet, very-low-frequency fire regime, favoring western hemlock over Douglas-fir.

Huff, M. H. (1984). Post-Fire Succession in the Olympic Mountains, Washington: Forest Vegetation, Fuels, and Avifauna. Dissertation. University of Washington. Seattle, Washington. (See also: Huff, M.H., Agee, J.K. and Manuwal, D.A. (1985), Postfire Succession of Avifauna in the Olympic Mountains. Paper presented at Symposium on Fire's Effects on Wildlife Habitat, Missoula, Mont., March 21, 1984. USFS Gen. Tech. Rpt. INT-186.)

The importance of fires in the long-lived forests of the Pacific Northwest is poorly understood. The lower montane zone in the Olympic mountains (Olympic National Park) was selected to study fire effects in west slope western hemlock (Tsuga heterophylla)/Douglas-fir (Pseudo-tsuga menziesii) forests. Vegetation, snags, dead and down fuels, and birds were examined along a post-fire chronosequence: years 1-3, 19, 110, 181, and 515. The objectives of this research were to document the successional patterns of a moist temperate coniferous forest following large lightning fires, and to determine the broad ecological effects of fires in these forests. Conclusions from this study:

- Overstory tree density and basal area were dominated by two species: western hemlock and Douglas-fir. On all sites, western hemlock was more common than Douglas-fir; the number of Douglas-firs decreased with stand age.
- The 1978 Hoh Fire caused extensive overstory tree mortality. On the study plots, only three large Douglas-firs survived the fire; these trees eventually died. The first year after the fire, numerous seedlings (73606/ha) became established, primarily western hemlock and Douglas-fir. By year 3 tree establishment ceased. However, regeneration continued at the 19-year-old site.
- The highest density of overstory trees (>5.5 cm dbh) was observed at the late yound sere, year 110 (700 trees/ha). Even though the density of Douglas-fir was far less than western hemlock at the year 110 and 181-year-old sites, Douglas-fir maintained dominance of tree basal area. Only a few large Douglas-firs were present at the 515-year-old-site, which was dominated numerically by young and old western hemlocks.
- Post-fire tree re-establishment spanned a 30-40 year period at the 110-year-old site. Most regeneration occurred 10-15 years after the fire. A much longer re-establishment period, extending 50-75 years, was observed at the 181-year-old site.
- Least-squares regression lines of diameter and age were examined at the 110-181, and 515-year-old sites. Weak or no relationships existed for Douglas-fir or western hemlock at any site.
- Generally, the amount and size of dead and down fuels were significantly different among the different aged study areas. Each fuel component or particle size showed different maximum and minimum patterns along the successional gradient.
- Avifauna that commonly breed in disturbance or mature-type forests were present in post-fire years 1to3. In year 1, the breeding density and diversity were similar to the nearby old-growth (pre-burn) forest. Breeding density and diversity decreased in years 2 and 3. The 19-year-old site maintained the highest number of species and the second highest density throughout the study areas. Diversity and density were lower at the closed canopy forest, except in the old-growth forest (year 515) where the highest avian density was recorded.

Huff, M.H. and Agee, J.K. (1980). Characteristics of large lightning fires in the Olympic Mountains, Washington. Proceeding of the Sixth Forest Meteorology Conference, April 22-24, 1980, 117-123. Seattle, Washington.
The objective of the study was to describe climatic characteristics of large lightning fires in Olympic National Park. Large fires were found to be related to the following average conditions: 1) Two years of below normal rainfall before ignition. 2) Below normal rainfall four of the five previous months before ignition. 3) Two consecutive months of below normal rainfall before ignition. 4) Twenty-two consecutive days without significant precipitation before ignition. 5) Fourteen consecutive days without significant precipitation after ignition. 6) Consecutive months of below normal rainfall and consecutive days without significant precipitation before ignition is significantly different from conditions in non-fire years. 7) Consecutive days without significant precipitation after ignition and consecutive years of below normal rainfall are highly correlated with the size of lightning fires larger than 50 ha. The climate of the 1978 Hoh Fire was found to be similar to large fires of recent decades.

Huff, M.H. and Agee, J.K. (1991). Subalpine forest dynamics after fire in the Pacific Northwest National Parks. National Park Service Cooperative Park Studies Unit, College of Forest Resources, University of Washington. Seattle, Washington.
Objectives of the study were to determine for a variety of older subalpine fires the tree establishment trends over time, and to use these data to evaluate generalizable patterns of stand development after subalpine wildfires. Study sites were chosen in North Cascades National Park Service Complex, Olympic National Park, and Mount Rainier National Park. *Seed Dispersal*: The relatively heavy seeds of subalpine fir, were substantially more common in seed traps placed 3 m from the seed source (residual tree clusters) than traps 12 and 43 m away. The lighter and smaller seeds of mountain hemlock were more abundant than subalpine fir in the traps furthest from the residuals, however mountain hemlock was not an important species in the dry subalpine areas that were studied. *Seed Germination*: A total of 3.1 percent of subalpine fir seeds germinated. The stratified seeds (refrigerated under moist conditions) germinated at a 5.0 percent rate compared to 1.5 percent for unstratified seeds. A relatively high proportion of the seeds were without embryos or were parasitized. *Tree Establishment Over Time:* The pattern of prolonged tree establishment on these burned sites for centuries suggests that the process of tree recruitment is dependent upon several factors coinciding: a good seed year the previous fall, little in-cone or subsequent predation of seed, a good seedbed (preferably bare ground) within a "safe site" for microclimate amelioration, and a moist summer providing sufficient water for the small seedling. The patterns of stand development are so prolonged in these environments that early stages of "stand initiation" may continue for over a century, and the "stem exclusion" stage may still be associated with some recruitment. The "understory reinitiation" stage may be so prolonged that the early subalpine fir dominants die before it is completed.

Huff, M.W., Agee, J.K., Gracz, M., and Finney, M. (1989) Fuel and fire behavior predictions in subalpine forests of Pacific Northwest National Parks. National Park Service Cooperative Park Studies Unit Report CPSU/UW 89-4, College of Forest Resources, University of Washington. Seattle, WA.
Fuel and fire behavior characteristics were quantified for subalpine fir (*Abies lasiocarpa*) sites in Olympic, North Cascades, and Mount Rainier National Parks. Sites ranged from recently burned to old growth. Fuel loading differed more by stand age than by subregion (e.g., Mount Rainier, North Cascades, Olympic). Fine fuel loads (1 and 10 hr timelag fuels) were 1.5 to 4 times higher in mature stands (125-250 years old) than in young stands (40-100 yrs old). Mature stands had larger loads of slightly decayed 1000 hr timelag fuels (7-20 cm diameter) but smaller loads of highly decayed fuels of that class. The larger loads of less decayed fuels are contributions from existing mature stands, while the highly decayed large fuels in younger stands are contributions from the pre-fire stand. Young stands had larger loads of >1000 hr timelag fuels (>20 cm diameter). Again, these represent biological legacies from the previous stand. Fuel moisture studies documented declines in foliar moisture over the season, from over 300 percent to about 120 percent on a dry weight basis. Fire behavior predictions using the BEHAVE system resulted in young stands being generally

more flammable than the mature stands for the late season conditions used in the predictions. Crown flammability, not considered in these predictions, will increase potential for erratic fire behavior in the subalpine forest mosaic.

Josephson, B. (1981) Effects of fire on elk and deer in montane forests of the Hoh River valley. In Ecological Effects of the Hoh Fire, Olympic National Park, 1980 Annual Report for National Park Service Contract CX-9000-9-0079. College of Forest Resources, University of Washington. Seattle, Washington.
The purpose of this study was to investigate the influence of fire on Roosevelt elk and Black-tailed deer by looking at the presence of these species in four lowland montane habitats. The habitats included a two-year-old burn (the 1978 Hoh fire site), the eastern edge of old growth forest bordering the Hoh fire, the interior of the old growth forest, and the 200-year old forest on the western edge of Mineral Creek, a tributary of the Hoh River. 'Winter' pellet groups of elk were encountered more frequently and were significantly more abundant in the zone of old growth forest which bordered on the two-year-old burn than in the other three habitats studied. 'Winter' pellet group densities in the 200-year-old forest, on the two-year-old burn, and in the old growth forest did not differ significantly. Edge zones may provide several of a species' habitat requirements in close proximity. The only one of the four habitats studied in which elk were present during the period when the animals fed on succulent forage was the two-year-old burn. Relatively low densities of deer pellets were encountered on the Hoh fire site and in the old growth forest edge. The relatively high densities of elk pellets and low densities of deer pellets encountered in this study may reflect an increase in the elk population at the expense of deer.

Josephson, B. (1981) Effects of fire on small mammal populations in montane forests of the Hoh River valley. In Ecological Effects of the Hoh Fire, Olympic National Park, 1980 Annual Report for National Park Service Contract CX-9000-9-0079. College of Forest Resources, University of Washington. Seattle, Washington.
The purposes of this study were: 1) to compare the species of small mammals trapped in a control area of virgin montane forest and on the 2-year-old Hoh burn in the western Olympic mountains and (2) to estimate population densities of small mammals trapped in relatively high densities on the Hoh burn. The deer mouse, Peromyscus maniculatus, was found both at unburned and burned forest sites. Yellow-pine chipmunks, Eutamias amoenus, were trapped only in the burned habitat. The density of deer mice in the area sampled was estimated to be 5.2 animals/ha.

Pickford, S.G., Agee, J.K., and Rauw, D.M. (1980). Interpreting the Natural Role of Fire: Implications for Fire Management Policy Acceptance in Olympic National Park. Final Report for National Park Service Contract CX-9000-9-0057. Cooperative Park Studies Unit, College of Forest Resources, University of Washington. Seattle, Washington. 26 p.
This cooperative study included a questionnaire to assess public knowledge and attitude concerning fire management; development and presentation of a slide tape program, "Fire: An Olympic Event"; and evaluation of the program via a pre-test/post-test fire quiz. Results from the fire quiz showed that park visitors' knowledge of fire and fire management significantly increased as a result of having viewed the program.

Pickford, S. G., Fahnestock, G. R., and Ottmar, R. (1977). Fuels, Weather, and Lightning Fires in the Olympic National Park. Final Report to National Park Service, contract CX-9000-6-0116. College of Forest Resources, University of Washington. Seattle, Washington. 97 p.
This cooperative study investigated fuels and weather as they influence fire potential in Olympic National Park. Fuels were inventoried for fuel loading and evaluated for rate of spread and resistance to control. Results were used to revise a 1941 fuel type map. Records of fire occurrence, thunderstorm occurrence and weather records were compiled for the park. The study concluded that 1) Fuels are not a critical variable governing the occurrence and spread of lightning-caused fires in the park; 2) Especially hazardous fuels,

created by disturbance and occupying relatively small, scattered areas, are serious hazards in areas heavily used by man; 3) Lightning fires occurring under conditions that permit control are unlikely to cause intolerable harm to park and surrounding resources if permitted to burn until extinguished naturally; 4) The probability of lightning fire occurrence depends upon time since significant precipitation; and 5) The most severe burning conditions are associated with the presence of an East Wind, which can generally be forecast 24 hours prior to occurrence.

Pickford, S.G., Fahnestock, G.R. and Ottmar, R. (1980). Weather, Fuel, and Lightning Fires in Olympic National Park. Northwest Science 54(2), 92-105.
This study describes fuel and weather conditions related to 747 forest fires, which burned 2502 ha in Olympic National Park, Washington (exclusive of the coastal strip), from 1916 to 1975. Of these fires, the 274 caused by lightning accounted for 81 percent of the area burned; 37 fires larger than 4 ha accounted for 96 percent of the area burned by lightning fires. Lightning started fires in only 22 of the 60 years, although 3-50 thunderstorms per year occurred during the summers of a 19-year sample period. Probability of one or more fires resulting from a thunderstorm depended on the number of days without 2.5 mm of rain preceding the storm. Eighty-seven percent of the fires and all but one of the fires larger than 40 ha burned in the northeasterly half of the park, presumably because of lower precipitation. More than half of the fires started above 1220 m elevation, and four-fifths above 915 m. Differences in fuel types and quantities had little influence on fire occurrence or behavior. Most fires started and most areas burned in the subalpine zone, which has the lightest, least continuous fuels.

Potash, Laura L. (1989). Sprouting of red heather (<u>Phyllodoce empetreformis</u>) in response to fire. Thesis (M.S.), University of Washington. Seattle, Washington
Vigorous sprouting of red heather (*Phyllodoce empetriformis*) after a 1981 wildfire stimulated this research into the reaction of red heather to fire. At the 1981 Chimney Peak fire (Olympic National Park) percent cover of red heather was compared at four sites: burned and unburned areas of (a) open meadows and (b) meadows with sappling-sized trees. Six years after the fire, unburned areas still had higher cover than burned areas. Areas closer to mature forest were less likely to have heather after burning. Location was interpreted to be important because areas near the forest edge had deeper litter layers, which can smolder in fires and kill heather rhizomes by creating higher temperatures near the soil surface. Wildfires at Mount Rainier (Mowich fire – 1987) and Olympic (Kimpta Peak fire – 1987) National Parks were surveyed for effects on red heather, and heather was found to be sprouting vigorously at both sites. Experimental treatments at North Cascades (Cascade Pass and Maple Pass) with small clip, light burn and heavy burn plots showed that burning did reduce new growth in the year following the prescribed fires, but had no significant effect on number of stems. Contrary to previous literature, red heather can survive natural wildfires, and such fires may, on a long-term basis, increase the vigor of the heather stand.

Taylor, K.L. (1988). Fuel structure and fire in subalpine fir forests, Olympic National Park, Washington. Thesis (M.S.), Western Washington University. Bellingham, Washington.
The fuel structure and flammability of subalpine fir stands on Hurricane Ridge was studied to determine the relationship between these forests and fire. The following measurements were taken: 1) Forest fuel loads at Hurricane Ridge were measured using two different methods; 2) the weather was monitored over the course of a summer; 3) fuel moisture was measured weekly; and 4) samples of forest fuels taken from the forest at weekly intervals were burned in a laboratory, measuring flame time, ember time, maximum flame height, and percent of fuel combusted. Results indicated that over twice as much fuel in subalpine forests accumulated around the bases of the fir trees than in the forest as a whole, and the many dead branches on the lower trunks of the trees may allow fire to travel up to the canopy. It was also found that, although the fuels in the subalpine forests were more flammable at the end of the summer than at the beginning, maximum flammability was achieved in early August when the fuel moisture was about 20%. The fuel structure of subalpine fir forests was different from that of fire stable ponderosa pine forests.

Wetzel, S.A. and R.W. Fonda. (2000). Fire History of Douglas-fir Forests in the Morse Creek Drainage of Olympic National Park, Washington. Northwest Science, 74(4), 263-279.
(See also: Wetzel, S.A. (1995). Fire history of *Pseudotsuga menziesii* forests of the Morse Creek drainage of Olympic National Park, Washington. Thesis (M.S.), University of Washington. Seattle, Washington.) This study quantified the fire history in the Morse Creek drainage to determine the role played by wildfire to favor dominance of Douglas-fir rather than late successional western hemlock. Germination dates and fire release markers were identified on increment cores from 318 Douglas-firs, and used to date past fire events. A 600-yr fire history was developed for this 2500 ha area. It appeared that periods characterized by many small-scale, low and moderate severity fires were interrupted by two high severity, stand-replacing fires. Mean fire return intervals were calculated for various land units. For a scale of 200 ha , the approximate mean size of lateral tributaries to Morse Creek, the mean FRI was 21 yr.

B. ON-GOING FIRE RESEARCH

Anderson, K. Reconstruction of Historical Land Use & Vegetation Patterns of the Ozette Prairies & Surrounding Vegetation of the Olympic Peninsula, Olympic National Park Through Ethnobiological Research. (Study in progress). Cooperative Agreement No. H9500020043 between the Department of the Interior, National Park Service, Olympic National Park and Regents of the University of California, Davis Campus. The purpose of the study is to investigate the extent to which the coastal peoples influenced the shaping of the Ozette Prairies and specifically their floral assemblage, both through harvesting strategies and land management techniques, emphasizing what is known regarding former indigenous burning and homestead burning practices. The principal investigator will achieve the objectives of the study through three methods: historical reviews, museum artifact analysis and oral interviews with non-Indians and tribal elders. The reconstruction of interactions between indigenous people and the natural environment will be useful in setting up ecological field experiments that mimic these practices. In turn the outcomes of these experiments can be used to write National Park Service prescribed burning and other management prescriptions for the Ozette Prairies.

Bach, A. (Study in progress). Soil Influences on the Existence of the Ozette (Ahlstrom's and Roose's) Prairies, Olympic National Park, Washington. Task Agreement No. WWU-01-2 to Cooperative and Joint Venture Agreement No. CA9088A0008 with the Cooperative Ecosystem Studies Unit (Western Washington University). The purpose of this research project is to evaluate the soil properties and vegetation distributions in and around Ahlstrom's and Roose's Prairies, Ozette region of Olympic National Park, in order to identify their origin, changes in size through time, and the relationship between soil, vegetation, and land-use (specifically burning). In 2001, the investigator's preliminary and limited sampling of the soils in the prairies suggested two things which additional detailed research should address and verify: there is a bog which has been present at the site for at least 2300 years; and the bog (opening in the forest) was expanded in size by burning. The specific objectives of this research are to determine 1) the timing of formation of the vegetation and fire history in order to demonstrate the longevity (suggested by the single radiocarbon date of 860 years) of the expanded prairie; 3) how the fire history related to the cultural history of the area; and 4) how the removal of the forest vegetation has influenced subsequent soil formation.

Fonda, R.W. (Study planned to begin in 2003). Community response to prescribed fire in old growth Douglas fir forests in the Morse Creek drainage, Olympic National Park, Washington.
Prescribed fire broadcast burns will be used in an effort to gain information about fire effects on old growth Douglas-fir forests in the Morse Creek drainage. The study site is in the Maiden Creek sub-drainage, west of the Deer Park Road. Six or seven experimental plots of about ½ acre (0.2 ha) each will be broadcast prescribed burned. The duration of the study is expected to be 2 years for immediate postfire response, and 5 years or longer for long-term postfire response. The research objectives are 1) Test conclusions in Wetzel

(1995) that 250+ year old forests dominated by Douglas fir in the Morse Creek drainage support low intensity, low severity surface fires that enhance the structure and health of the stand. Specifically, the long-term structure should include light surface fuels, a tree layer of larger, widely spaced Douglas firs, and ~60% cover of understory shrubs and a few saplings. 2) Reduce Douglas fir, western hemlock, and western redcedar reproduction (<4" diameter) in the stand by 50-95%. Mortality of these young trees is one of the main targets of the prescribed fire. A few small trees might remain in pockets or small groups in the plots. 3) Reduce fuel loads by 20-50%. Current fuel loads are 16-21 tons/acre, of which 45-56% are fine fuels (Wetzel 1995). 4) Promote postfire growth of larger Douglas fir trees, consistent with the data presented by Wetzel (1995) that tree rings for at least 10 years after an understory burn will be significantly larger than the years preceding the fire. 5) Promote the postfire growth of understory species, especially salal. Many of the understory species in these forests are resprouters. Although postfire cover might decrease in the first year, frequency should not change significantly. Eventually, greater understory cover should be realized.

Gremel, S. A. (Study in progress). Factors controlling distribution and productivity of northern spotted owls in a reserved landscape.
The three objectives of this thesis project are to: 1) Describe the effects of barred owls competition on spotted owls; 2) Determine habitat similarities and differences between the two species (including stand age as one of the variables); 3) Determine the importance of stand-replacing disturbance, primarily fire, in initiating and maintaining high quality spotted owl habitat. At each study site, a 9 ha plot is being evaluated to estimate the time since stand replacing disturbance and the proportion of the plot that dates to this disturbance. Measurements of owl survival rates and reproductive rates will be analyzed to determine the relationship between stand age and these variables. The study will also provide descriptive data on the range of stand ages spotted owls occupy in this environment.

Estberg, G. N. (Study in progress). Lightning Climatology Study
Cloud to ground lightning data for Western North America (monitored by an automated detection network) was obtained from the Scripps Institution of Oceanography. This data is being examined in connection with other climate patterns to try to predict lightning discharge patterns in advance. This is part of a larger "season in advance" wildfire prediction effort underway at Scripps. At this point, aggregated data for 1994-2000 has been displayed as a three-dimensional scatter plot using SPSS software provided by the University of San Diego. Individual strike data has also been displayed for the Olympic Peninsula using GIS software provided by the park.

C. NEEDED RESEARCH

Fire History
The fire history of the park is incomplete. The park has fairly good records of fire activity from the 1930's to present, but information on fires previous to this period is scattered at best. Inferences can be drawn from the mosaic pattern of many past fires, but this does not truly indicate the final size of the fires, just the size of the portion of the stand that was killed during the fire. As funding becomes available, further research into the fire history of the park is necessary to fully understand the affects of fire on the landscape. Initial research projects should be concentrated upon those areas with the lowest fire return intervals.

Fire Effects.
Fire research is needed following the occurrence of large fires, to determine the effects of fire and fire suppression/holding actions on the vegetation, water quality, and stability of soils.

Hazard Fuel Reduction

Research is needed to determine the long-term effects of hazard fuel reduction around structures on endangered species and vegetation.

Research is also needed to determine how frequently sites must be re-treated to protect wildland-urban interface areas.

Air Quality
Further research may be needed to determine the number of acres that can be burned without violating air quality regulations. Monitoring equipment may be needed to establish the baseline particulate load in the Park's air shed and how much management fires add to it.

CHAPTER VIII
Public Safety

A. PUBLIC SAFETY ISSUES AND CONCERNS

Public safety is a concern in those situations where a fire could overtake individuals or communities. Smoke is an additional concern where it could obscure visibility along roads or where it was dense enough to cause health problems.

Under average fire danger conditions, fires in the Olympics are relatively slow moving, allowing containment before they threaten human life and safety. Under severe or extreme conditions, however, there is potential for fast- moving, intense crown fires. The limited amount of road access in the park, and the potential for roads or trails to be cut off by fire, complicate the task of protection and evacuation. It may be difficult to contact visitors who are scattered in backcountry areas.

Roads
The park-wide road system includes 69 miles (110 km) of paved roads and 99 miles (158 km) of graded roads. Highway 101, which circles the peninsula and passes through the park, handles a high volume of traffic. It is the only road that connects the Olympic Peninsula to the Puget Sound lowlands. Several other roads finger into the park from Highway 101, but do not cross it. These roads are located in the following areas: Staircase, Dosewallips, Deer Park, Hurricane Ridge, Elwha, Soleduck, Ozette, Mora, Hoh, Queets, and Quinault. Several other park trailheads are accessed by USFS roads and logging roads, many of them unpaved. All of these roads pass through heavily forested areas.

Recreational Developments
The primary administrative and visitor use areas are located along the roads described above and on popular trails. Administrative and recreational facilities include the Headquarters Complex, 16 front-country ranger stations, 21 front-country campgrounds, 35 picnic sites, 3 visitor centers, 6 concession facilities (4 with overnight lodging). Over 1,200 campsites are scattered throughout the backcountry of the park.

Communities, Inholders and Neighbors

There are approximately 390 parcels of private property within the boundaries of Olympic National Park, and these properties total about 500 acres (200 ha). All of these properties are in the Exclusion Unit. Most of the private property within the park is located at Lake Crescent, Quinault, Ozette, and Oil City, with a few additional properties at Elwha, Heart of the Hills, and along the coastal strip. A number of private structures outside the park are located within one mile of the park boundary. The greatest concentrations are at Lake Dawn, and along the Hurricane Ridge Parkway.

B. PROCEDURES FOR MITIGATING SAFETY ISSUES

B.1. UNPLANNED IGNITIONS

The incident commander and on-scene personnel will immediately take those steps necessary to protect incident personnel, visitors, residents and non-incident employees.

Life-threatening situations will be managed in the same manner as any other time critical emergency and will have priority over all other fire actions or communications.

Small, low-intensity fires may not pose any immediate threat to public safety, but action may be taken to promptly contact all persons in the fire area and advise them of the fire situation and potential, safety considerations, communication procedures and safe travel routes.

Fast-moving, high-intensity fires may require that all non-fire personnel in the vicinity be evacuated from the fire area. In these situations, the Incident Commander will coordinate the evacuation with the District and/or FMO. Evacuation procedures:

1. Prevent additional people from entering hazardous or potentially hazardous areas. Post roads and trails. Inform the public of closures via press release, visitor center notices, the internet and phone recordings. Station information personnel at visitor centers, key road junctions and trail junctions. Enlist the assistance of local law enforcement personnel, as necessary. Inform park staff through radio, phone, and electronic messages.

2. Determine if evacuation is needed, and the timeframe available for evacuation.
   a. Evaluate current and projected fire behavior and fire growth.
   b. Determine who is presently in the area.
      Assign law enforcement rangers and/or firefighters to determine if there are people in the fire area whose safety would be threatened by the fire, and provide a communication link with those people. In front-country areas, a ranger may be sent to check parking areas, spur roads and campsites to determine the current location of visitors, employees and residents. Residents may be contacted by phone or in person. To locate campers in the backcountry, the park's "Tracker" backcountry permit system can be used to help identify the probable locations of backpackers. Vehicles left at trailheads provide clues to additional people who may be in the backcountry on day hikes (or on un-permitted overnight trips). Backcountry rangers will usually have additional information about the location of people in their area. It may be necessary to check trails on foot, and cross-country areas by air in an effort to locate all the people in an area. It is important to list and keep track of all of the people who are located, and maintain communications with them.
   c. Decide if evacuation is necessary.

3. Identify the nearest safety zones where people may be assembled for evacuation, or assembled to wait for dangerous conditions to pass.

4. Direct people to safety zones by relaying information through ranger and fire staff.

5. Determine the mode(s) of transportation needed to evacuate people. This may include vehicle, boat, foot and/or helicopter. Check on availability of these resources.

6. Coordinate with neighboring agencies who may be affected by the evacuation, or who may aid in the evacuation.

7. Assign a checkpoint where those who are evacuated can be signed-out after evacuation. Make sure that everyone is accounted for.

8. When executing the evacuation, use available safety precautions, such as PPE on helicopter flights, and a lead car to convoy cars down smoky roads.

B.2. PRESCRIBED BURNS

Smoke mitigation measures include: limiting number of acres and amount of fuel burned; timing prescribed burns to minimize smoke impacts on air quality and visibility utilizing favorable conditions of atmospheric stability, mixing height and transport winds; specifying an acceptable range of moisture content and wind conditions for each prescribed burn; coordinating with other agencies and land owners to limit the number of burns occurring simultaneously; and promptly mopping-up prescribed burns. No prescribed pile burn will be ignited in a drainage that is already affected by a fire larger than 200 acres. All prescribed burning and debris disposal must comply with regulations contained in the Washington State Department of Natural Resources (DNR) Smoke Management Plan and Regulation 1 of the Olympic Air Pollution Authority (OAPCA). If the burning meets the definition of silvicultural burning under the Washington Clean Air Act, then the park must contact DNR Smoke Management for approval; all other burning is regulated by OAPCA. The park will notify tribal representatives of prescribed fire operations in the tribes usual and accustomed places.

A prescribed burn plan will be prepared for each project. These site-specific plans will include all of the required elements listed in Reference Manual – 18 Wildland Fire Management. Among those elements, the following are most closely tied to safety:

- Risk management: The process of identifying and controlling hazards to protect resources and property. For example, local roadways could be impacted from drift smoke and some traffic control may be required to reduce risks.

- Prescribed fire complexity rating: This is a method to assess the complexity of a prescribed fire, and guides determination of the organizational structure and level of experience/qualifications of the burn boss needed to successfully implement the project.

- Prescription: This lists acceptable values for key weather and fire behavior parameters necessary to achieve desired results.

- Ignition and holding actions: This section includes identification of critical holding areas. Critical holding areas are areas where it is critical to limit the spread of fire. There may be a variety of reasons for an area to be considered critical, including concerns such as: protection of human safety; preventing the fire from growing too large; preventing the fire from moving into difficult fuels; preventing the fire from moving onto private property; and protection of cultural sites, threatened and endangered species, special category plants, air quality or other resources.

- Wildland fire transition plan: This identifies actions and notifications needed when the prescribed fire exceeds project boundaries and cannot be controlled within one burning period using on-site holding resources.

- Public and Firefighter Safety: This describes the public and personnel safety and emergency procedures. This section identifies safety hazards in and outside the project area; measures taken to reduce or mitigate those hazards; and Emergency Medical Service personnel assigned.

- Smoke management: This describes how the project will comply with air quality regulations and how to reduce potential impacts of smoke production and smoke-related safety and health issues, if required. (This would include coordination with affected residents who have special health concerns related to smoke).

- Interagency coordination and public information: This identifies actions, timelines and responsibilities for interagency and intra-agency pre-burn coordination and public involvement.

- Technical review: This helps ensure that a prescribed fire plan is written in a manner that allows the stated goals and objectives to be safely and successfully achieved when properly implemented.

CHAPTER IX
Public Information and Education

A. CAPABILITIES AND NEEDS

Education and interpretation is an important process in public understanding of the fire management program at Olympic. The Fire Management Officer will coordinate all fire related public information activities with the assistance of the Fire Program Assistant, the Park's Public Information Officer, Chief Ranger, Chief of Interpretation and the Deputy Superintendent. The Fire Management Officer will provide accurate information regarding current fire situations and management activities. Other staff specialists will be consulted as needed to provide information or resources to assist the public information program.

B. STEP-UP PUBLIC INFORMATION ACTIVITIES

The public information program will be developed as follows:

1. Concepts of the wildland fire use program will be incorporated, in appropriate park publications, brochures and handouts.

2. During periods of fire activity or high fire danger, aspects of the fire management program, emphasizing fire prevention, will be incorporated into visitor contacts, interpretive talks, walks and campfire programs. Particular attention will be given when fires are noticeable from roads or visitor use areas.

3. During periods when wildland fires are burning, temporary handouts will be prepared and posted and/or distributed to visitors entering areas of fire activity. This message shall include general information on the fires in the park and health hazards of smoke, as well as other pertinent information. Messages may be placed on the park's public radio information network.

4. News releases will be distributed to the media as appropriate.

5. The public information outlets of cooperating agencies, the NPS Seattle Support Office and the regional office will be provided with all fire management information on fires larger than class C (> 10 acres) or when multiple ignitions occur. Public Information Officers working for the Fire Information Officer may be placed in local, affected communities during periods of high fire activity.

6. The role of natural fire in the Olympic ecosystem will be developed and discussed, as appropriate, in off-site programs and talks.

7. The fire management program will be discussed in informal talks with employees of all divisions, concessionaires and residents.

8. The fire management staff and sub-district rangers will work with park inholders to inform them of the wildland/urban interface problems that will be faced with their specific properties. Recommendations will be made to remedy those problems.

As outlined in the prevention section, emergency closures or restrictions may become necessary during periods of extreme or extended fire danger. These activities will be coordinated with all divisions by the Fire Management Officer, through the Chief Ranger and Assistant Superintendent.

Olympic National Park strongly supports the role of local fire prevention programs on the Peninsula. There are currently two fire prevention associations located on the Peninsula: the North Olympic Fire Prevention Association and the Grays Harbor Fire Educators Association. Both of these associations are dedicated to educating the residents of the Olympic Peninsula in both structural and wildland fire prevention. The Park's role in the North Olympic Association is the public education of elementary school children by way of prevention presentations during various times of the year, primarily held prior to the fire season, as well as providing general fire safety messages to the public during fire season. Due to the North Olympic Association serving the Port Angeles, Sequim, Forks and Quilicene areas, meetings in closer proximity to the park headquarters and serving a higher population base that abuts the park, the park has made the commitment to fully support this organization. The park will continue to take an active role in this association to further educate the future and present users of National Park Service areas. The current commitment from the park for participation in this program involves the Fire Management Officer and/or the Prescribed Fire Specialist, as well as the fire forestry technician and as available a staff member the Resource Education/Interpretation Division to help promote quality presentations. Due to the distance involved in attending the Grays Harbor Association, the park normally serves in a de facto role, usually assisting by through email.

b. KEY CONTACTS

The following is a list of key agency, interagency, state and congressional delegation contacts for potential inclusion in each WFIP at the Stage III level:

Agency
NPS, WASO, Office of Public Affairs
NPS Seattle Support Office: Visitor Protection
NPS Pacific West Region: Fire Management Officer
Mount Rainier National Park: Superintendent
North Cascades National Park: Superintendent
Crater Lake National Park: Superintendent

Interagency Contacts
Bureau of Indian Affairs, Aberdeen
Clallam County Sheriff's Office: PENCOM
NW Indian Fisheries Commission: Information Officer
Olympic Coast National Marine Sanctuary: Manager
Olympic National Forest: Forest Supervisor
Olympic National Forest: Fire Staff
Olympic National Forest: Public Information Officer
Olympic National Forest, Pacific Ranger District
Olympic National Forest, Hood Canal Ranger District
Puget Sound Agency
Puget Sound Interagency Communication Center
State of Washington Department of Ecology
State of Washington Department of Natural Resources- Olympic Region:
State of Washington Department of Natural Resources
State of Washington Department of Parks and Recreation Commission: Director
State of Washington Department of Trade & Economic Development: Tourism Development Division
US Army/Ft Lewis Forestry
U.S. Coast Guard Station Air Station, Port Angeles
U.S. Coast Guard Station, Quillayute River

U.S. Fish and Wildlife Service, Dungeness Wildlife Refuge
U.S. Fish & Wildlife Service, North Pacific Coast Ecoregion, Western Washington Office

Tribes
Hoh Tribe
Jamestown S'Klallam Tribal Council
Lower Elwha S'Klallam Tribal Council
Makah Tribal Council
Port Gamble S'Klallam Tribe
Puget Sound Agency
Quileute Tribal Council
Quinault Indian Nation
Skokomish Tribal Council
Suquamish Tribal Council

Fire Departments / Fire Districts
Clallam Fire District #2
Clallam Fire District #3
Clallam Fire District #4
Clallam Fire District #5
Clallam Fire District #6
Grays Harbor Fire District #4
Jefferson County Fire District #4
Jefferson County Fire District #7
Mason County Fire District #1
Mason County Fire District #18
Port Angeles Fire Department

U.S. Legislature
- Representative in Congress, 6th Congressional District: (Norm Dicks)
- Senator (Maria Cantwell)
- Senator (Patty Murray)

State Legislature
- District 24 Senator (Jim Hargrove)
- District 35 Senator (Tim Sheldon)
- District 24 Representative (James Buck)
- District 24 Representative (Lynn Kessler)
- District 35 Representative (Kathy Haigh)
- District 35 Representative (William Eickmeyer)

CHAPTER X
Protection of Sensitive Resources

This chapter contains a summary of sensitive resources requiring special protection, and a description of actions to prevent or mitigate negative impacts to these resources. See the Fire Management Plan Environmental Assessment for a more detailed discussion of each of these sensitive resources.

See also Appendix F. Olympic National Park Minimum Impact Tactics, for a description of environmental precautions that help protect all sensitive resources.

A. ARCHEOLOGICAL/ CULTURAL/ HISTORIC RESOURCES

1. Summary of Archeological/Cultural /Historic Resources

Currently, Olympic National Park has within its cultural resources database approximately 150 prehistoric sites and 520 historic sites. The general distribution of the known cultural sites (structures, landscapes, districts and archaeological sites) in the park are shown in Appendix A: Map 6.

Cultural resources include:
- Prehistoric cultural resources, such as midden deposits, lithic scatters, pictographs, culturally modified trees, and petroglyphs.
- Ethnographic resources which combine elements of cultural and natural resource values, such as an area of natural vegetation that is utilized for ceremonial or religious purposes. They may also include structures, features, objects or landscapes that were utilized by the group. Other examples include village sites, campsites, gravesites, vistas, glaciers, rivers or other geologic features, and prairies that may have been enhanced through Native American burning.
- Historic Resources (Structures and Landscapes), including human-made sites, structures, features or objects, which date from the time of the arrival of Euro-Americans up until the middle of the 20th century (i.e., at least 50 years of age). Historic sites can include Native American-associated structures and places, but most often they are associated with the Euro-American settlement era.

2. Actions to Prevent or Mitigate Negative Impacts to Archeological/Cultural/Historic Resources

a. FIRE SUPPRESSION AND WILDLAND FIRE USE

In addition to the standard course materials presented during refresher training and/or basic training, all firefighters will receive instruction in the identification of and impacts to cultural resources.

Olympic National Park Minimum Impact Tactics will be used in all fire management activities. See Appendix F.

Additional precautions are necessary in the following situations:
- The fire is in the vicinity of known cultural sites.
- The fire is located in a sensitive location that has a high probability of having been used in prehistoric times. Sensitive locations include ridges, saddles, mountain lakes and meadows.
- The fire is 10 acres or larger (size class C or larger).
- A Cultural Resources advisor should be assigned if the fire is larger than 10 acres in size.
- Firefighters are engaged in activities that have potential for disturbing sensitive sites. These

activities include improvement of helispots, safety zones, spike camps and escape routes, and/or use of these areas for more than 48 hours.

In these situations the fire management office will consult with cultural resource management staff within 12 hours of size-up for advice on whether a cultural resource advisor should be assigned to the incident, and advice on how to protect the cultural resources at risk. For fires in the vicinity of known cultural sites, the Cultural Resource Fire Protection Matrix (Appendix G), is an additional tool to help guide protection activities.

Rehabilitation plans for each fire will be jointly formulated and initiated by the Fire Management Officer, the Incident Commander and the appropriate park resource advisor(s) and staff, both natural and cultural. Cultural Resource Management (CRM) staff will determine if cultural resources were damaged by the fire event or associated suppression actions, and if key cultural sites are likely to be damaged by fire related catastrophic soil movement. The CRM staff will assure that rehab actions do not damage cultural resources.

b. HAZARD FUEL REDUCTION, HISTORIC SCENE MAINTENANCE AND PRESCRIBED FIRE

It may be determined that fuels manipulation around cultural or historical resources may be necessary to accomplish hazard fuels reduction to protect the structures from wildfire, to accomplish historic scene maintenance, or maintain cultural practices. Various fuels management techniques, such as prescribed burns or mechanical reduction with pile burning may be utilized to accomplish these goals.

The Cultural Resources Division maintains a complete listing of known sites within Park boundaries and will be consulted in the planning phase of any prescribed fire actions.

B. NATURAL RESOURCES AND FEATURES

B.1. WILDERNESS RESOURCES

1. Summary of Wilderness Resources

The Wilderness Act of 1964 established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as “wilderness areas”. By law these 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, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness” (16 U.S.C. 1131).

In November 1988, Congress designated approximately 95 percent of Olympic National Park as wilderness under the terms of the Wilderness Act. See Appendix A: Map 7 Designated Wilderness.

Many visitors enjoy the park wilderness. Figures for the year 2000 show that 34,648 overnight visitors used the park’s wilderness, in backcountry stays ranging from one night to two weeks. Backcountry use included 11,907 parties and totaled 81,218 visitor use nights. Group size was comprised of six or more persons on 5.4 percent of the trips, while groups of two people accounted for 51.5 percent of the trips. Backcountry users have access to over 600 miles (965 km) of trail through wilderness areas. The majority of the backcountry visitors utilize the trail system, however, a small percentage prefer to travel cross-country. Most backcountry use occurs during the relatively dry summer months.

2. Actions to Prevent or Mitigate Negative Impacts to Wilderness Resources

All management decisions affecting wilderness must be consistent with a minimum requirement concept The purpose of the "minimum requirement concept" is to reduce the effects of management on wilderness character and values. The minimum requirement process provides a method for developing, evaluating, and selecting the actions that provide the least intrusion on wilderness character and values. The concept is to be applied to all management actions, programs and activities that have potential to affect wilderness and potential wilderness additions. The minimum requirement process will be applied at Olympic through use of the "Minimum Requirement Worksheet". (See Appendix E. Minimum Requirement Process.) The Minimum Requirement Process will be used prior to commencement of each individual site prescription in the wilderness and the associated use of tools for those individual sites. This document also helps guide the response to suppression of fires in the wilderness and the minimum tool for these operations. Use of the Minimum Requirement Process is required for post-fire rehabilitation actions as well as suppression activities.

Olympic National Park's Minimum Impact Tactics and other environmental mitigation measures will be used park-wide, in all fire management operations.

B.2. SPECIAL CATEGORY PLANTS AND ANIMALS

1. Summary of Special Category Plants and Animals

There are 9 endemic plant species and more than 50 rare or sensitive (state-listed) plant species within ONP. (See Fire Management Plan Environmental Assessment Appendix F-2 Special Category Vascular Plants.) At this time, there are no known federally listed special status vascular plants within Olympic National Park, however there are four USFWS species of concern, one of which is thought to be extirpated.

Several wildlife species listed by the U.S. Fish and Wildlife Service under the Endangered Species Act occur within the vegetation communities of the park. Listed as threatened are the marbled murrelet (Brachyramphus marmoratus), northern spotted owl (Strix occidentalis caurina) and bald eagle (Haliaeetus leucocephalus). Additionally, the following federally listed endangered or threatened wildlife species may be found in the vicinity of the park: brown pelicans (Pelecanus occidentalis), the short-tailed albatross (Phoebastris albatrus), and the western snowy plover (Charadrius alexandrinus). Other federally listed marine animals occurring in or near the park's coastal area include: the Green sea turtle (Chelonia mydas), the Leatherback sea turtle (Dermochelys coriacea), the Loggerhead sea turtle (Caretta caretta), the Olive ridley sea turtle (Lepidochelys olivacea), the humpback whale (Megaptera novaeangliae), the blue whale (Balaenoptera musculus), the fin whale (Balaenoptera physalus), the sei whale (Balaenoptera borealis), and the sperm whale (Physeter macrocephalus). Also found in the park is the Mazama pocket gopher (Thomomys mazama), a species of concern for Washington State, and a candidate species under the ESA.

The following fish species are listed as threatened or candidate species under the Endangered Species Act: Coastal/Puget Sound (C/PS) bull trout (threatened); Puget Sound (PS) Chinook (threatened); Hood Canal (HC) Summer Chum (threatened); Ozette Lake (OL) Sockeye (threatened); and Puget Sound/Strait of Georgia Coho Salmon (candidate). Additionally, 60 species of groundfish, Chinook salmon and Coho salmon, and five species of coastal pelagic fishes may occur in areas designated as Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act.

2. Actions to Prevent or Mitigate Negative Impacts to Special Category Plants and Animals

a. ALL ACTIVITIES

Olympic National Park Minimum Impact Tactics will be used in all fire management activities. See Appendix F.

b. SUPPRESSION

In addition to the standard course materials presented during refresher training and/or during the basic training, all firefighters will receive instruction in:

- the purpose and objectives of the fire management program;
- fire ecology in park ecosystems; and
- information regarding appropriate considerations and constraints to protect wilderness values and endangered species during suppression operations.

Unwanted fires (human-caused fires and fires which do not meet criteria for wildland fire use) will be suppressed.

A Wildland Fire Situation Analysis (WFSA) will be prepared for fires that are not contained or controlled by initial attack forces. The WFSA is a decision making process that evaluates alternative management strategies against selected safety, environmental (including air quality), wilderness, social, economic, political, and resource management objectives.

The Natural Resource Management Division will assist in consultation concerning impacts on endangered or threatened species, special category plants, and air quality issues. The division will assist in the development of the Wildland Fire Situation Analysis.

The Natural Resource Management staff may provide resource advisors for assignment to wildland fires. A natural resource advisor will be requested for all fires class C or larger (10 acres or larger). Resource advisors may be assigned for smaller sized fires, dependent upon location of the fire and potential impacts to species or resources of concern. Resource management staff will assist in determining impacts of fire management activities and developing post-fire rehabilitation projects.

Fires requiring rehabilitation will have plans jointly formulated and initiated by the Fire Management Officer, the Incident Commander and the appropriate park resource advisor(s) and staff, both natural and cultural. Rehabilitation will be directed toward minimizing or eliminating the effects of the suppression effort had on vegetation, trails and the control of unwanted exotics from encroaching upon the site. Rehabilitation activities may require Section 7 consultation with USFWS for T&E species. The assigned resource management advisor(s) will determine the need for consultation. Rehabilitation will be started prior to complete demobilization of resources.

On smaller fires, the firelines will be pulled back to cover exposed soils, water bars will be installed as necessary, and stumps will be flush-cut and camouflaged.

c. WILDLAND FIRE USE

Wildland fire use will be limited to 200 acres (81 ha) per year in areas where there is suitable habitat for Northern Spotted Owls or Marbled Murrelets, with an allowance for an additional 600 acres (243 ha) to be managed as wildland fire use in one year out of five, unless further consultation is undertaken. (In addition, wildland fire use will be limited to 500 acres (202 ha) per year in areas outside of suitable habitat.) Wildland

fire use that has potential to exceed these acreage figures, but meets all other wildland fire use criteria, will be considered candidates for wildland fire use management only with additional environmental analysis and consultation.

A Wildland Fire Implementation Plan (WFIP) will be prepared for each wildland fire use action. The WFIP will identify holding actions that may be taken to check, direct or delay the spread of the fire along one or more fire fronts and minimize threats to life, property and resources.

A natural resource advisor will be requested for all fires class C or larger (10 acres or larger). Resource advisors may be assigned for smaller sized fires, dependent upon location of the fire and potential impacts to species or resources of concern. Resource management staff will assist in determining impacts of fire management activities and developing post-fire rehabilitation projects.

d. HAZARD FUEL REDUCTION

An interdisciplinary team will help develop site-specific hazard fuel reduction plans. Non-fire treatment project plans will include all of the required elements listed in Reference Manual – 18 Wildland Fire Management, including sections on the protection of sensitive features, and monitoring.

- Protection of Sensitive Features: This identifies treatment and mitigation needed to protect cultural sites, threatened and endangered species, special category plants, private property or other sensitive features; and
- Monitoring: This describes the pre-, during, and post-treatment monitoring needed to evaluate whether project objectives have been met and if the project is being conducted within prescription.

During the nesting seasons of Marbled Murrelets, no cutting will be performed within two hours of sunrise or sunset.

e. PRESCRIBED FIRE

A prescribed burn plan will be prepared with interdisciplinary involvement, for each project. These site-specific plans will include all of the required elements listed in Reference Manual – 18 Wildland Fire Management, including sections on: ignition and holding actions, protection of sensitive features, and monitoring.

- Ignition and holding actions: This section includes identification of critical holding areas. Critical holding areas are areas where it is critical to limit the spread of fire. There may be a variety of reasons for an area to be considered critical, including concerns such as: protection of human safety; preventing the fire from growing too large; preventing the fire from moving into difficult fuels; preventing the fire from moving onto private property; and protection of cultural sites, threatened and endangered species, special category plants, air quality or other resources.
- Protection of sensitive features: This identifies treatment and mitigation needed to protect cultural sites, threatened and endangered species, special category plants, private property, or other sensitive features.
- Monitoring: This describes how monitoring of prescription elements will take place pre-ignition and during the burn; and specifies how both long and short-term fire effects will take place pre-burn and post-burn to evaluate if project objectives have been met.

B.3. SOIL AND WATER RESOURCES

1. Summary of Soil and Water Resources

a. SOILS

The soils of the Olympic Peninsula reflect a varied environment and complex history, but are generally quite young. The complex geologic history of the Olympics has left a diversity of parent materials for soils to form from. Bedrock on the Peninsula includes a variety of sedimentary rocks and marine basalts. Much of the lowland and valley bottoms are covered with glacial sediments, which may or may not have been derived locally. Since the retreat of the glaciers, deep piles of colluvium have accumulated in the valleys and on the slopes of the mountains. Rivers have reworked whatever sediments were left in the valley bottoms and have spread sheets of alluvium along their courses. Volcanic ash from Mt. St. Helens' eruption in 1980, as well as Mazama ash deposits from more than 6,800 years ago have been identified on Olympic soil. Additionally, soil is altered by various quantities and types of annual precipitation, a 7,000 foot range in elevation and topography that extends from flat to vertical.

b. RIVERS AND STREAMS

River and stream resources within the park include river-cut canyons, examples of glacially eroded canyons, active glaciers, alpine lakes and coastal lands along the Pacific Ocean. The park's rivers are relatively unimpaired, with the exception of the Skokomish River that has a hydro-electric dam located outside the park; and the Elwha River, which has dams both inside and outside the park. The federal government currently owns the two Elwha River dams and is in the planning process for removal of the dams.

There are thirteen rivers within the park that are eligible in a preliminary analysis to be designated as part of the Wild and Scenic Rivers System under the Wild and Scenic Rivers Act. These rivers include the following:

- Skokomish River
- Duckabush River
- Dosewallips River
- Royal Creek
- Gray Wolf River
- Elwha River
- Soleduck River
- Calawah River
- Bogachiel River
- Hoh River
- Queets River
- Quinault River
- Ozette River

The park has not conducted the second step of the wild and scenic river study process, i.e. the determination of suitability. Therefore, there are no recommendations on Wild and Scenic River designations within the park at the present. Many of the eligible portions of these rivers are within designated wilderness, and the protections afforded by this designation are more stringent than the Wild and Scenic River designation.

c. FLOODPLAINS, WETLANDS AND LAKES

Floodplains are associated with many rivers and streams within the boundaries of the park. The upper reaches of these river courses are often steep and are in steep-sided valleys. As the rivers exit the higher

mountains, their floodplains are often formed by the braided nature of the streambeds. Vegetation typical of Olympic Peninsula lowlands includes cottonwoods, alder, maple, and other riparian plants that take advantage of the abundance of water. High water events have led to streambed movement across the valley bottoms, often putting park roads and facilities at risk from flooding or washout. The streambeds of the west side rivers are extremely active. Previous homesteading efforts in the west side river valleys encountered repeated flooding. Repeated efforts to limit the water flow in more predictable channels met with varied success during this homesteading period.

Freshwater wetland ecosystems are found within the ONP boundaries and include ponds, marshes, seasonally flooded meadows and riparian areas. Wetlands include lands which are transitional between terrestrial and deep-water habitats, where the water is at or near the surface, along with isolated areas where water is also near the surface. The presence of certain soil types, plant species, and a regime of water presence define wetlands. Wetlands are found within the interior portions of the park as well as along the coast. Wetlands serve important functions including flood protection, erosion protection, sediment filtration, and water storage for release during drought periods. They also provide habitat and food for a variety of wildlife species including mammals, fish, birds, insects, and microscopic organisms. They may provide economic benefits such as recreational opportunities, education and research.

Both lakes and wetlands are catalogued together as waterbodies within the park's GIS database. There are approximately 650 lakes and wetlands, totaling 13,978 acres (5,657 ha) within the Olympic National Park. The mean size of these areas is 21.54 acres (8.7 ha), which includes lake size, and the median of all areas is 0.31 acres (0.13 ha). Wetlands in ONP tend to be on the small size whereas open water constitutes the larger portion (mean acreage).

2. Actions to Prevent or Mitigate Negative Impacts to Soil and Water Resources

Protection of soils/water/wetlands and riparian resources is accomplished by minimizing soil disturbance and conducting post-fire rehabilitation where needed. (See Appendix F: Olympic National Park Minimum Impact Tactics.)

The park is also developing site specific prescriptions for protection of riparian/ shoreline areas. The emphasis of these prescriptions will be on the establishment of up to 250-foot no touch buffers in perennial, fish bearing streams, and in areas with unstable slopes. Proposed prescriptions for intermittent streams (non-fish bearing) could include up to 200-foot no touch buffers.

Emergency spill response is the response to any amount of a regulated waste or hazardous material that is spilled to the environment (air, land, surface waters, ground waters) that may detrimentally affect health, the environment, or property. If, in the course of fire management activities there is a spill of a regulated waste or hazardous material (such as oil used in chainsaws or diesel used in drip torches), personnel will follow the Spill Prevention Control and Countermeasures (SPCC) Plan for Olympic National Park. The SPCC plan lists the people who must be contacted and what procedures must be followed to control, contain, remove and clean up hazardous material spills.

Rehabilitation of areas disturbed by fires or fire suppression actions could include "Fire Suppression Activity Damage" and "Emergency Fire/Burned Area Emergency Rehabilitation". Fire Suppression Activity Damage includes the repair and rehabilitation of damage to lands, resources, and facilities that is directly attributable to the wildland fire suppression effort or activities. Examples of rehabilitation needs may include: camps and staging areas, damaged facilities (fences, buildings, bridges, etc.), handlines, dozer lines and roads. Emergency Fire/Burned Area Emergency Rehabilitation (EFR/BAER) activities are planned actions taken during and after a wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire. As a general rule, burned

areas that are not managed to preserve a cultural or historic scene will be allowed to regenerate naturally. Seeding or planting non-native or even native species produces unnatural changes in successional patterns and vegetative communities and should be used only as last resort to prevent erosion damage or to combat invasion of non- native species.

B.4. AIR RESOURCES

1. Summary of Air Resources

a. CLASS I AREA

ONP is designated as a Class I area under the Clean Air Act, as amended in 1977. All surrounding areas are considered Class II areas. Class I areas are afforded the highest degree of protection under the Clean Air Act. This designation allows very little additional deterioration of air quality. The Clean Air Act states that managers have an affirmative responsibility to protect park air quality related values (including visibility, odor, flora, fauna, geological resources, archaeological resources, soils resources, and water resources) from adverse air pollution impacts.

b. OLYM AIR QUALITY

Monitoring in the park indicates that air quality within the park is relatively good. Campfires, generators, heating systems and the operation of motor vehicles and equipment all may cause local, temporary air quality degradation. Eilers et al. (1994) evaluated all available air quality information on Olympic National Park, as well as research conducted in similar ecosystems elsewhere. Based on the limited data evaluated it was concluded that "no air pollutants currently pose a significant threat to terrestrial resources in OLYM".

Stationary and mobile emissions in the region are the major sources of air pollution near the park. These include:

- Motorized vehicles
- Paper mills (Daishowa America Co. Ltd. in Port Angeles; Grays Harbor Paper Lp; and Port Townsend Paper Corp.)
- Lumber mills and veneer dryers (K Ply in Port Angeles; Port Angeles Hardwood in Port Angeles, Simpson Timber in Shelton; Simpson Door in McCleary)
- Sand/gravel/asphalt companies (Lakeside Industries in Port Angeles)
- Residential woodstoves
- Urban development
- Prescribed forest burning and wildland fires.
- Industries located within the Puget Sound Basin

c. MONITORING SITES AND STUDIES

The only continuous air quality monitoring site in the park was established as part of the NPS service wide monitoring network in 1983 in front of the park's visitor center in Port Angeles. In 1985, the station was moved to its current location 0.1 mile south of the visitor center. Currently, Sulfur Dioxide (SO_2), Ozone (O_3), dry deposition (National Dry Deposition Network) and meteorological parameters are measured at that site. Washington State Department of Ecology operates a nephelometer to monitor visibility at Hurricane Ridge during summer months. A National Atmospheric Deposition Program

(NADP) monitoring site has been in place at the Hoh Ranger Station since 1980. A National Acid Precipitation Assessment Program (NAPAP) site was established on West Twin Creek in the Hoh Valley in 1984. An EPA National Dioxin Air Monitoring Network station was installed at Ozette in 1999.

Industrial and urban emission sources that most immediately affect the north side of the park are located in Port Angeles. SO_2 and O_3 levels measured at the park's air quality site do not violate federal or state air quality standards. Levels of SO_2 at the park's site are usually lower than those measured in downtown Port Angeles, probably due to greater distance and topographic shielding from industrial sources. Prevailing winds that often affect emissions and subsequent air quality are said to hail from the west to southwest direction during fall and winter months, and from west to northwest during the spring and summer months. Light scattering (b_{sp}) and total suspended particulates (TSP) values are highest in the winter, probably due to wood stove emissions in residential areas surrounding the park's monitoring site.

The Olympic Air Pollution Control Authority (OAPCA) conducted a multiple-site saturation particulate matter (PM_{10}) study in winter 1996/1997 to document impacts of wood stoves in the Port Angeles area. This study used portable PM_{10} monitors as well as a nephelometer to determine the adequacy of the permanent PM_{10} monitoring station at the City Light building in Port Angeles. OAPCA's permanent sampler has never recorded values exceeding the National Air Quality Standard for PM_{10}; neither did the portable samplers or the nephelometer during the 1996/1997 study.

PANORAMAS (Pacific Northwest Regional Aerosol Mass Apportionment Study), an EPA-funded study, was conducted during 1984 to examine visibility and regional haze in Washington, Oregon and Idaho (Beck and Associates, 1986). The study concluded that regional haze in the Pacific Northwest was produced by sources within the region. The principal source of haze was vegetative burning (slash fires, wildfires, agricultural burning). Within the Pacific Northwest, the lowest median visual range (100 to 150 km) was within the coastal, marine areas of western Oregon and Washington where most agricultural and silvicultural burning occurs. Of the Class I areas in the three states, ONP had the lowest median visual range (60 to 80 km) due to frequent influence of coastal weather patterns.

d. VISIBILITY

The Fire Management Plan must be in conformance with the Clean Air Act and the Washington State Smoke Management Plan. Smoke impacts must not adversely affect public health or welfare, and must comply with State and National Ambient Air Quality Standards (NAAQS) and visibility protection requirements for any affected Class I area. In Section 13, *Air Quality in Wilderness* (Director's Order 41), park managers are given direction: "Managers will be responsible for reducing the impacts of smoke from wildland fires on visibility in Class I wilderness, while understanding and promoting the need to re-introduce the natural role of fire into wilderness ecosystems."

One of the concerns for fire management is avoiding prolonged smoke impacts on the views that are most important to park visitors, as well as protecting the overall park visibility. The view from the Olympic Mountains can be spectacular. At times when the view is unimpeded by clouds, haze or smoke, visitors can enjoy views of:

- The Cascade mountain range to the north and east;
- Mt. Rainier to the southeast;
- Vancouver Island and the San Juan Islands to the north;
- The Puget Sound Basin to the east; and
- The Olympic Mountain range in all directions.

Park staff identified important scenic views from park viewpoints in 1980. The scenic viewpoints included, but are not limited to, Lookout Rock, Hurricane Ridge, Hurricane Hill and Deer Park; all heavily visited areas. Additional vistas may be added as identified by park staff and planning documents.

e. DESIGNATED AREAS AND SMOKE SENSITIVE AREAS

Designated areas are critical areas in Washington State designated by the Department of Ecology that are otherwise subject to air pollution from other sources. These currently are Port Angeles, Spokane, Grays Harbor, Raymond, and the I-5 corridor from Bellingham south to Vancouver.

Smoke sensitive areas are special areas in and near the park where elevated concentrations of pollutants from smoke may cause human health or environmental impacts. In addition to the designated areas above, Sequim and the Hood Canal (along the Highway 101 corridor) are included as smoke sensitive areas. They include areas of heavy recreational use and population centers outside designated areas. Additional smoke sensitive areas may be identified and added to the Fire Management Plan as they are designated. See Appendix A: Map 8 Smoke Management Designated Areas and Smoke Sensitive Areas, for designated areas and smoke sensitive areas in or near Olympic National Park.

2. Actions to Prevent or Mitigate Negative Impacts to Air Resources

Objectives:
The air quality objectives of this plan are to 1) manage smoke from fire management activities in accordance with Federal, State and local regulations, 2) mitigate and prevent unacceptable impacts of the fire management program on public health, and 3) limit the impacts to the parks important viewpoints and general visibility.

Regulations:
The Fire Management Plan and fire management activities must be in conformance with the Clean Air Act; State and National Ambient Air Quality Standards (NAAQS); the Washington State Smoke Management Plan, and the Revised Washington State Visibility Plan.

OLYM Guidelines
The guidelines listed below will be used to minimize the effects of smoke on the air quality of the park and of the surrounding areas. The Superintendent can grant exceptions to these guidelines.

a. ALL FIRES

Safety First:
Human health and safety is foremost during any fire operation. Every attempt will be made to limit smoke exposure of the general public and firefighters working on the fire.

Weather Forecasts:
The Fire Management Office will utilize the National Weather Service Land Management Weather Forecast (which includes information on atmospheric stability, mixing heights and transport winds) during the planning and decision process to determine how the smoke is likely to disperse. The National Weather Service can also provide spot weather forecasts.

Complaints:

Complaints regarding smoke will be documented and communicated to the Fire Management Officer, for daily consideration and inclusion into the fire package. The Fire Management Officer will work closely with the Park's air quality staff on all smoke issues.

Monitoring:
Because the park currently does not have any set air quality monitoring stations that monitor smoke impacts in the interior of the park, the park must place greater reliance on visual monitoring techniques. If smoke sensitive receptors located around the park are not likely to be affected by a small scale or short duration incident, then visual monitoring may be acceptable. Posting personnel on potentially affected roadways to monitor for smoke and to initiate safety measures for motorists will be necessary if smoke is likely to or does impact roadways. Utilizing aircraft to track the progress of the smoke plume, continued tracking of meteorological conditions during the fire, and a network of persons at the various sensitive receptors visually monitoring for smoke impacts are examples of monitoring techniques that may be utilized. At a minimum during wildland fire use activities, smoke will be monitored for trajectory, mixing height and impact to air quality sensitive areas. Ambient monitoring may be warranted for projects which are expected to be multiple day events and/or may potentially exceed the national ambient air quality standards (NAAQS).

b. PRESCRIBED FIRES AND PILE BURNS

Alternatives:
All projects considering use of prescribed fire will evaluate feasible alternatives to fire that would achieve similar resource management objectives. If fire is to be utilized, actions will be taken to minimize prescriptive fire emissions. Prescribed burning would be implemented if other alternatives would not meet resource management objectives or would be too difficult to implement.

Clearances:
- All prescribed burning and debris disposal will comply with regulations contained in the Washington State Department of Natural Resources (DNR) Smoke Management Plan and Regulation 1 of the Olympic Air Pollution Authority (OAPCA).
- State air quality clearances and permits will be obtained prior to the initiation of any prescribed fires, if required. It may be necessary to suppress certain prescribed fires if smoke affects a sensitive area or if it creates a significant public response or impact on human health, and it is determined that these factors outweigh the gains of the resources benefits of that particular fire. All prescribed fire activities will be curtailed when an inversion or air pollution episode is in effect.

Prescribed burn plans:
- Each prescribed fire burn plan will include a section on smoke management. This section will describe how the project will comply with air quality regulations, and how to reduce or mitigate potential impacts of smoke (including safety and health issues, if applicable). It will also address coordination with affected residents who have special health concerns related to smoke.
- The prescribed burn plan will consider the direction, duration and effects of smoke both by day and by night. Various computer programs (i.e. SASEM) may be utilized to help predict downwind smoke impacts and smoke production outputs.
- Smoke management objectives in the prescribed fire plan must be quantifiable and measurable. Measurable objectives may include legal standards, minimum visual range, duration of smoke detected by either sight or smell, transport wind speed, an/or mixing heights. As with other objectives, data must be collected by monitors to show if the objectives were met.

Timing:

- Prescribed fires and pile burns will not be ignited on weekends or holidays without the Superintendent's approval.
- Prescribed burns and pile burns will not be ignited in a drainage that is already affected by a large wildfire or prescribed fire (200 acres or larger). The Park will coordinate prescribed fires with neighboring agencies
- In accordance with regulations of the State of Washington DNR and local Air Pollution Control District, prescribed fires will not be ignited on "no burn" days unless variance is obtained from the State of Washington DNR and/or appropriate Air Pollution Control District.
- To minimize smoke, prescribed fires should be conducted when prescribed fuel moistures are as low as possible, yet still provide for a controllable fire.

Notifications:
The Washington Department of Natural Resources, Olympic National Forest, PENCOM dispatch, local affected Indian Nations and the appropriate Air Pollution Control District will be notified prior to any prescribed fire. If significant smoke may be produced, or if the smoke will be highly visible, a press release will be issue to notify the public.

Public Information:
The importance of fire, and the resulting smoke, in natural systems will be emphasized to the public and regulatory agencies. Contact with local civic groups, handouts and interpretive walks/presentations will help the public to understand why their vistas are temporarily obscured. Monitoring equipment may be needed to give assurance that no health hazard exists to the general public from prescribed fires and wildfires.

Protecting Smoke Sensitive Areas (see Appendix A: Map 8):

- Prescribed fires will normally not be scheduled on weekends between Memorial Day and Labor Day if the smoke is likely to affect a Smoke Sensitive Area. If possible, burns will be conducted outside this period.
- During periods of stagnant air, prescribed fires should not be ignited if the smoke plume may accumulate in a Smoke Sensitive Area. Stagnant air may occur when a low-pressure weather system stalls off the coast (cut-off low) or there is a stubborn inversion over the area.
- Emphasis will be placed on using prescribed fire when winds at plume dispersal heights are blowing away from populated areas. Exceptions to this may be made in some locations to avoid burning during severe east wind conditions.
- If significant smoldering sends smoke into a Smoke Sensitive Area seven days after the last ignition, aggressive mop-up will be seriously considered.
- Carbon monoxide monitors and particulate matter monitors should be obtained or borrowed from the Air Pollution Control District, if dense smoke (visual range less than 100 feet) is expected in smoke sensitive areas, to document the presence or absence of actual air quality violations. Management actions, particularly on similar fires in the future, will be guided by this data.

Typical prescriptive criteria:

- Visibility impacts will be limited to no worse than the 20th percentile of the norm for no more than 5 consecutive days. (Local cooperating agency air equipment and data may be utilized to monitor this impact.)
- Visible haze or smoke plumes from prescribed fire will not be visible over at least half of the horizon for at least four hours a day from critical viewpoints within two days of the last ignition and will disperse within 30 miles downwind of the fire, as observed from a point perpendicular to the smoke trajectory.
- Visible accumulations of smoke under valley or canyon inversions will be dispersed by 1000 AM daily.
- The forecasted mixing height should be at least 1,700 feet higher than the fire site, and transport winds

greater than 9 miles per hour.

- Some standard should be specified to gauge public reaction to the smoke. The Prescribed Burn Boss might specify that the prescribed fire will be suspended or mopped up, with no further ignition, if a given number of written or phoned in complaints are received. Experience with prescribed fires near developed areas will give the Prescribed Burn Boss a feeling for the relationship among prescribed fire size, smoke density and duration and visitor complaints.

Ignition:
The ignition technique or techniques will be suitable to meet both fire management objectives and air quality standards to the fullest extent possible. Backing fires produce less scorch and particulates than do headfirst, but the latter type burns areas more quickly and has shorter smoke episodes, if fuel moisture is low enough to minimize smoldering.

Roadway Safety:

- Smoke on the highway, lasting even a few seconds, can cause serious, even fatal accidents. It is the responsibility of the Prescribed Burn Boss to ensure that signs are placed, which warns the public on the highway/roadway, and posted reduced speeds through the area. If smoke is crossing any state roads, any posting of temporary speed limit reduction must be coordinated with Washington State Patrol and the Washington State Highway Department. Required Minimum speed limits are:

Visual Range	Posted Speed
0-200 feet	15 mph (NTE park posted speed)
201-350 feet	25 mph (NTE park posted speed)
351-550 feet	35 mph (NTE park posted speed)
551+ feet	45 mph (NTE park posted speed)

- Warning signs and speed limit signs should be checked frequently (scheduling of patrol is specified in the prescribed fire plan) to insure that the signs are properly placed and effective. Nighttime smoke in particular tends to flow down drainages, resulting in the pooling of smoke where highways cross the drainage. Such smoke patterns can be anticipated and signs placed in advance of this occurrence. Monitoring is required to ensure effective placement.

Termination of burn:
Fires that are exceeding air quality objectives will generally be suppressed following the preparation, review and approval of a WFSA. The public will be informed that although no new ignitions are occurring, smoke may persist and may temporarily increase as a result of control actions.

Research:
Further research may be needed to determine the number of acres that can be burned without violating air quality regulations. Monitoring equipment may be needed to establish the baseline particulate load in the Park's airshed and how much management fires add to it.

c. WILDLAND FIRE USE:

Fire managers are also guided by Director's Order 41 *Air Quality in Wilderness*, Section 13, which states that, "Managers will be responsible for reducing the impacts of smoke from wildland fires on visibility in Class I wilderness, while understanding and promoting the need to re-introduce the natural role of fire into wilderness ecosystems."

The park's ecosystem and wilderness values may take short-term precedence over the air quality and visibility values of the park during fires managed as a wildland fire use actions. These short-term impacts may be considered acceptable, as the long term gains in the ecosystem and wilderness values (including allowing natural processes to occur) may be more beneficial.

a). Candidate wildland fire use actions will be evaluated for their individual and cumulative impacts on air quality and visibility, with close consideration of potential impacts to viewpoints, including but not limited to those at Lookout Rock, Hurricane Ridge, Hurricane Hill and Deer Park.

b) Smoke emissions will be monitored on all wildland fire use actions to identify health concerns.
It may be necessary to suppress certain prescribed or wildland fire use actions when smoke affects a sensitive area or it creates a significant public response or impact on human health, and it is determined that these factors outweigh the gains of the resources benefits of that particular fire. All fire activities may have to be curtailed when an inversion or air pollution episode is in effect.

B.5. RESEARCH NATURAL AREAS AND ELK EXCLOSURES

1. Summary of Research Natural Areas and Elk Exclosures

Four Research Natural Areas (RNA's) are designated in the park. RNA's preserve discrete plant communities and other natural features for scientific and educational purposes. All four RNA's in Olympic are within the Exclusion Unit, but it is important to consider that fire itself may cause less damage to these basically unmodified sites than such fire suppression activities as fireline construction, tree felling and aerial retardant drops. Whenever a fire approaches or threatens an RNA, a resource advisor will be assigned and on site with the firefighters.

The four RNA's currently designated are:

- Hades Creek-560 acres Bogachiel River drainage
- Twin Creek-100 acres Hoh River drainage
- Jackson Creek-160 acres Hoh River drainage
- Higley Creek-480 acres Quinault River drainage

Elk exclosures are fenced study areas designed to exclude ungulates, providing opportunities for biologists to compare browsed and unbrowsed ranges. The largest of the five exclosures in the park is slightly over one acre in size. All of the current exclosures are within the Exclusion Unit. Construction of additional exclosures is not anticipated. To maintain scientific validity, exclosures and the surrounding area must be managed as a unit. Protecting only the exclosure from fire, for example, makes no sense if the surrounding range, which serves as the control, is allowed to burn. For the purposes of this plan, exclosure complex defines the actual fenced area and its immediate surrounding area. A one-acre exclosure is the core of a six to eight-acre exclosure complex.

The five exclosures in the park are:
- Kloochman Trail (Big Fir) - Queets River drainage
- South Fork Hoh - (2) South Fork Hoh River drainage
- Mosquito Creek - Bogachiel River drainage
- Hughes Creek - Elwha River drainage

2. Actions to Prevent or Mitigate Negative Impacts to Research Natural Areas and Elk Exclosures

Human-caused fires in or threatening RNA's will be suppressed as quickly as possible in accordance with the management objectives of this plan regarding the Exclusion Unit. If, however, suppression can be accomplished in a timely manner without control activities within the RNA, and, if in the end less overall damage to the site ecology of the RNA will result, modified suppression is preferred.

Lightning fires in or threatening RNA's will be suppressed as quickly as possible, but every effort will be made to avoid control activities within the RNA. The effects of natural fire are not incompatible with RNA management goals and it would be more prudent to allow the fire to pass through the RNA than direct suppression efforts within it.

In all cases, post-fire rehabilitation within RNA's is not appropriate and will not be performed.

Human-caused fires in or threatening an elk exclosure complex will be suppressed. As with RNA's, control activities within the exclosure complex should be avoided where reasonable and prudent. Natural fire is not incompatible with exclosure management goals. Unwanted fires may require suppression actions to be taken, but control activities will not be permitted within the complex itself. Lightning fires within the exclosure complex will be allowed to burn and will be suppressed when necessary to prevent adverse fire effects on other values-at-risk to prevent fire spread outside the park.

Rehabilitation of exclosures must be performed immediately after the fire is extinguished but is limited to repair or replacement of the fence structure. No vegetative manipulation is appropriate.

C. DEVELOPMENTS AND OTHER IMPROVEMENTS

1. Summary of Developments and Other Improvements

Administrative sites in the park include: the Headquarters complex, 16 front-country ranger stations (each a complex of buildings), 21 front-country campgrounds, 35 picnic sites, 3 visitor centers, 6 concession facilities (4 with overnight lodging), 6 backcountry patrol cabins, several ranger tent platforms, 28 three-sided shelters, and numerous pit-toilets. Other park structures include historic buildings, housing units, utility systems, trailhead facilities, and radio repeaters. Over 1,200 designated campsites are scattered throughout the backcountry of the park.

The park-wide road system includes 69 miles (110 km) of paved roads and 99 miles (158 km) of graded roads. The park-wide road system also has 27 bridges, ranging in length from 32 to 235 feet (9.8 – 71.6 m). Most bridges are concrete, with only a handful of the log and timber stringer-type still in service. The trail system includes 611 miles (978 km) of trail and 32 bridges ranging in length from 40 to 120 feet (12-37 m), with hundreds of smaller spans and foot-logs. There are approximately 12 miles (19 km) of wood-decked puncheon or boardwalk in the park.

Most of the roads and front-country structures are located in the Exclusion Unit. Most of the backcountry structures are located in the Conditional and Wildland Fire Use Unit.

There are approximately 390 pieces of private property within the boundaries of Olympic National Park, and these properties total about 500 acres (200 ha). Most of the private property within the park is located at Lake Crescent, Quinault, Ozette, and Oil City, with a few additional properties at Elwha, Heart of the Hills, and along the coastal strip. Surrounding the park are lands managed by the U.S. Forest Service,

Washington Department of Natural Resources; and private landowners including large timberland companies (Appendix A: Map 9 "*ONP and Surrounding Land Ownership*").

2. Actions to Prevent or Mitigate Negative Impacts to Developments and Other Improvements

a. SUPPRESSION

The exclusion units provide a buffer area where fires are suppressed, thus reducing the chance that an uncontrolled wildland fire will compromise human safety and neighboring lands. The boundaries of the exclusion units were chosen to capitalize on natural containment features such as ridgetops and valley bottoms (where there is less slope); and to provide a relatively safe distance between the wildland fire use unit and developed areas or neighboring properties.

Structures and developments will be protected from fire, with the stipulation that management actions must keep safety as the number one priority. Management actions must also take into consideration wilderness values, natural and cultural resources, and cost-effectiveness. Suppression activities may be modified or limited to protect ecosystem processes and wilderness values.

Should an unwanted fire occur, the closest available firefighting forces will be dispatched to the fire regardless of whether the fire is on park-owned property or privately owned property within the park.

b. WILDLAND FIRE USE

Only fires within the Wildland Fire Use Unit or Conditional Unit will be considered for management as wildland fire use fires. Fires outside these units and fires that could not be contained in these units will be suppressed.

The Wildland Fire Implementation Plan for each Wildland Fire Use project will identify any additional precautions needed for specific projects, such as coordination with affected residents who have special health concerns related to smoke.

Residents and individuals who could be affected by a particular Wildland Fire Use project will be notified by the park through press releases, and/or individual contact as appropriate. Information will be provided regarding measures that individuals can take to minimize their exposure to smoke. An interdisciplinary team will help develop site-specific hazard fuel reduction plans. Non-fire treatment project plans will include all of the required elements listed in *Reference Manual – 18 Wildland Fire Management*. Among those elements, the following two will aid in the protection of developments and other improvements:

- Protection of Sensitive Features: This identifies treatment and mitigation needed to protect cultural sites, threatened and endangered species, special category plants, private property or other sensitive features.

- Public and Personnel Safety: This describes public and personnel safety and emergency procedures. It identifies safety hazards on and outside the project area; measures taken to reduce or mitigate those hazards; and Emergency Medical Service personnel assigned. This section addresses the safety of visitors, residents, local property owners, personnel, and any other people whose safety could be affected by the treatment.

c. HAZARD FUEL REDUCTION

Manual/ mechanical treatment and pile burning will be used as a preventative measure to reduce hazard fuels and provide defensible space around administrative sites, historic structures, wildland-urban interface communities, and roadways. This will enhance protection of these structures from wildland fire. Up to 200 acres per year will be treated on a cyclic basis in an effort to eventually maintain lower fuel loads on about 1,000 acres. For the purposes of impact analysis, these acreage figures include work that the park will perform on its own lands and work that private land owners within park boundaries may choose to perform on their own properties. Removal of hazard fuels on private land is at the discretion of the landowner. (The landowner will still be responsible for meeting the requirements of scenic easements, Washington State Forest Practices Act, etc.) Recent legislation (the Wyden Amendment) and future funding may allow the park to enter into an agreement with the private landowner to assist with treatment on private property in those cases where it is to the benefit of both parties.

An interdisciplinary team will help develop site-specific hazard fuel reduction plans. Non-fire treatment project plans will include all of the required elements listed in Reference Manual – 18 Wildland Fire Management. Among those elements, the following is closely tied to protection of developments and other improvements:

- Protection of Sensitive Features: This identifies treatment and mitigation needed to protect cultural sites, threatened and endangered species, special category plants, private property or other sensitive features. The NPS is also sensitive to the aesthetics of the backcountry experience and will take action to prevent or minimize the impact of wildland, prescribed, and structural fires on cultural resources, including the impact of suppression and rehabilitation activities. Properly executed hazard fuel reduction is a treatment that should not be readily apparent to most hikers. Treatment will thin fuels and open the canopy in the immediate vicinity of the shelter, but will not create a clearcut.

d. PRESCRIBED FIRE

A prescribed burn plan will be prepared for each project. These site-specific plans would include all of the required elements listed in *Reference Manual – 18 Wildland Fire Management.* Among those elements, the following three are closely tied to protection of developments and other improvements:

- Risk management: The process of identifying and controlling hazards to protect resources and property. For example, local roadways could be impacted from drift smoke and some traffic control may be required to reduce risks.

- Ignition and holding actions: This section includes identification of critical holding areas. Critical holding areas are areas where it is critical to limit the spread of fire. There may be a variety of reasons for an area to be considered critical, including concerns such as: protection of human safety; preventing the fire from growing too large; preventing the fire from moving into difficult fuels; preventing the fire from moving onto private property; and protection of cultural sites, threatened and endangered species, special category plants, air quality or other resources.

- Protection of sensitive features: This identifies treatment and mitigation needed to protect cultural sites, threatened and endangered species, special category plants, private property, or other sensitive features.

CHAPTER XI
Fire Critiques and Annual Plan Review

After all fires, fire use actions and prescribed burns an after action review should be conducted. The after action review serves as a debriefing of the incident, to determine what went right and corrective actions to fix any issues that arose, as well as lessons learned. Most reviews will last between 15-30 minutes for a non-complex type 5 incident, to several hours for a full operational review of a more complex fire. The Superintendent, Fire Management Officer and/or Incident Commander will determine the need for a more complete review. The Interagency Standards for Fire and Aviation Operations Handbook and RM-18 provides guidance on the format for after action reviews. The fireline pocket guide also provides a summary of what is needed for an after action review.

Immediately following the fire season, the Fire Management Officer will meet with the Superintendent's Management Team to review and critique the season and recommend program changes. Any critical needs that may result in changes to this plan, will be incorporated into a revision of the Fire Management Plan and forwarded to the Regional Office, through the Superintendent for approval. Less critical changes may be documented and changed during the five year revision process of this plan.

Every five years, the fire plan will be reviewed. Any additional compliance needed will be completed and the plan rewritten as necessary, with new signature pages completed.

The Fire Management Officer will distribute approved changes of the plan to all field areas.

CHAPTER XII
Consultation and Coordination

The following list is a list of the primary personnel involved during Consultation and Coordination of this fire plan. While there were other personnel consulted in the update of this plan over the past 15 years while balancing the fire management activities with mitigating and lessening impacts to endangered species to the greatest extent possible, only the most recent contacts are included.

Mark Gray, Fire Regulation & Fuel Management Coordinator,
Washington Department of Natural Resources
Paul Hampton, Fire Prevention/Training
Washington Department of Natural Resources, Olympic Region
Jim Heuring, Fire Management Officer
Washington Department of Natural Resources, Olympic Region
Sue Husari, Regional Fire Management Officer
National Park Service, Pacific West Region
Dave Johnson, Fire Staff
Mt. Baker-Snoqualmie National Forest
John Holcomb, Quilicene District FMO (since transferred)
Olympic National Forest
John Kraushaar, Regional Deputy Fire Management Officer (since retired)
National Park Service, Pacific West Region
Paul Miller, Biologist, Gifford Pinchot NF
National Marine Fisheries Service
Brian Mitchell, Environmental Protection Specialist
National Park Service, WASO – Air Resources Division
Judith Rocchio, Physical Scientist, Air Resources
National Park Service, Pacific West Region
George Rubiaco, Fire Staff
Olympic National Forest
Linda Saunders-Ogg,
United States Fish and Wildlife Service
Charles Scripter, GIS Specialist, State Office, Spokane, WA
National Resources Conservation Service
Richard Stender, Technical Services Unit Supervisor / Meteorologist
Washington State Department of Ecology, Air Quality Program
Richard Smedley, Fire Planner (since retired)
National Park Service, Pacific West Region
Ken Till, Assistant Regional Fire Management Officer
National Park Service, Pacific West Region
Mark Whisler
United States Fish and Wildlife Service