Mount Rainier

National Park Service
U.S. Department of the Interior

Mount Rainier National Park

Hazard Tree Management Plan
Environmental Assessment

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Executive Summary

Mount Rainier National Park is proposing to establish a hazard tree removal program that slightly alters current methodology in hazard tree identification, assessment, monitoring and treatment, including a systematic approach to hazard tree management based on professionally recognized criteria. Alternative 2 of this Environmental Assessment would implement this approach, which is consistent with PW-062, Hazard Tree Management (DOI NPS 2009); PW-062 supersedes the previous Directive dated May 17, 1993 and the "1993 Western Region Guidelines for Managing Hazardous Trees" and any subsequent guidelines.

Under the proposed hazard tree management program, trees would be identified and treated in approximately twenty frontcountry areas, at wilderness campsites and along park roads as needed. As part of the program, up to 200 trees would be treated each year, typically distributed throughout the park. In addition, initial treatment would include backlog treatment of approximately 450 trees. Treatment methods would vary, but would emphasize moving or removing the target and other actions that would minimize tree removal. To minimize the number of total trees removed, alternate methods of treatment such as topping trees and removing limbs, would be used when possible. The removal of hazard trees would primarily consist of individuals in widely dispersed areas within the park. Removal of more than ten percent of the trees in an area at one time or over time would require separate environmental analysis to determine consistency with the effects concluded in this analysis. Concurrent with the removal would be the replacement of these trees with seedlings or the release of existing understory trees if present, with the goal of maintaining or slightly increasing stand density. Under the Hazard Tree Management Plan, individual interdisciplinary analysis and documentation would be required for hazard tree treatments. Proposed treatments would be reviewed to ensure that the treatment met certain criteria outlined in the plan.

The identification and removal of hazard trees in parkwide developed areas, such as at Longmire, Ohanapecosh, and White River, within public campgrounds, and along park roads, is an ongoing park program to decrease the potential risk to visitors and employees from falling trees. Courts have determined that agencies are obligated to conduct a hazard tree management program when visitors are invited to recreate in forested areas. Mount Rainier's program includes the description, assessment and routine monitoring of potential hazard trees based on documentation of defects or other conditions that contribute to tree failure. The goal of the plan is to systematically evaluate and treat hazardous trees to provide a stronger margin of safety for visitors and employees, as well as protection to facilities and property, than would be available with no hazard tree management program. Trees removed under this program are those that without treatment would be highly likely to fall on their own within five years. The proposed program also minimizes impacts to vegetation, threatened and endangered species, historic structures, cultural landscapes and other park resources. Mitigation of potential effects to listed species would include timing of treatment, especially of felling trees. Heavy snows and strong winds that often occur during winter create a need to remove newly damaged or fallen trees that block road access, or pose an immediate risk to facilities. These actions, along with emergency removal of hazard trees are not considered part of the Park hazard tree program.

Two alternatives are presented for analysis, including a continuation of current management (Alternative 1: No Action) and a move to a more comprehensive and systematic evaluation system with accompanying changes (Alternative 2). This Environmental Assessment is intended to serve as both a programmatic analysis of the park hazard tree management program as well as for specific analysis of proposed actions (backlog treatment). The new plan is considered a ten-year plan, intended to expire in 2020.

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I. PURPOSE AND NEED

Introduction

Mount Rainier National Park encompasses 235,625 acres on the west side of the Cascade Range, about 65 miles southeast of Seattle and 65 miles west of Yakima (Figure 1). The park was established in 1899 ". . . for the benefit and enjoyment of the people. . ." The park is managed to "provide for the preservation from injury or spoliation of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition" (Mount Rainier National Park Organic Act 1899).

More than half of Mount Rainier National Park is comprised of coniferous forest. Long-lived trees, such as Douglas-fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*) grow to more than 200 feet tall. These and other species are susceptible to insect infestations, fungal diseases and high winds. (Note: High winds can cause even sound trees to fail and these failures cannot be predicted by hazard tree analysis). Over time these and other environmental conditions, such as heavy snow loading, fires, soil erosion, soil compaction and damage from recreational use, can lead to structural failure.

Because most campgrounds, administrative and maintenance facilities, and employee houses are within forested parts of the park, tree failure may result in serious harm to people (including visitors and employees) and property (including buildings and structures, utility systems and/or vehicles). Mitigating tree hazards to an acceptable level, as defined by a systematic and documented process of analysis of trees in developed areas, is one goal of National Park Service management in Mount Rainier National Park. Figure 2 displays Management Zones identified in the Mount Rainier National Park General Management Plan (2002).

Mount Rainier National Park is proposing to establish a hazard tree removal program that slightly alters current methodology in hazard tree identification, assessment, monitoring and treatment and by conducting more regular hazard tree surveys. Under the preferred Alternative (2), the methodology of hazard tree evaluation would be consistent with PW-062, Hazard Tree Management (DOI NPS 2009), PW-062 supersedes the previous Directive dated May 17, 1993 and the "1993 Western Region Guidelines for Managing Hazardous Trees" and any subsequent guidelines. Up to two hundred trees would be treated per year, in addition to a backlog of approximately 450 trees that are identified in this EA. The 2009 Mount Rainier National Park Hazard Tree Management Plan is designed as a ten-year plan.

This Environmental Assessment has been prepared to satisfy the requirements of the National Environmental Policy Act (NEPA) of 1969 as amended, including the Council on Environmental Quality (CEQ) regulations found at 40 CFR 1500 *et seq*. This Environmental Assessment also facilitates compliance with National Park Service policy and a variety of other federal laws enacted for the protection of the environment, including Section 106 of the National Historic Preservation Act, Section 7 of the Endangered Species Act, the Wilderness Act, Clean Water Act, and the Clean Air Act.

NEPA requires the documentation and evaluation of potential impacts resulting from federal actions on lands under federal jurisdiction. An Environmental Assessment discloses the potential environmental consequences of implementing a proposed action and other reasonable and feasible alternatives.

NEPA is also intended to provide decision-makers with sound knowledge of the environmental consequences of the alternatives available to them. The superintendent of Mount Rainier National Park and the Pacific West Regional Director are faced with a decision regarding whether to change the hazard tree management program for Mount Rainier National Park as described herein.

Purpose and Need

A hazard tree is one which can fail due to a structural flaw or defect and is within striking distance of a valuable target (structure, vehicle, person, tent, etc.). Because "All trees within striking distance of a target pose some hazard no matter how sound (Harvey and Hessburg 1992)," all trees within striking distance are evaluated to determine if defects are present that would contribute to more immediate failure. A hazard tree management program is a well-documented systematic method of analysis and implementation to identify and correct tree hazards to prevent damage to people and property.

To comply with National Park Service Management Policies (NPS 2006) and NEPA, a systematic, well-documented approach to hazard tree management is needed. A systematic approach will:

- Reduce the risk of tree hazards to park visitors, employees and property;
- Integrate, refine and document reliable and highly defensible standards for hazard tree identification, evaluation and mitigation;
- Maximize the benefit/cost ratio of the hazard tree program, both in terms of property damage prevented and money expended for inspection and implementation;
- Maintain a balance between mitigating hazard trees, preserving park ecosystems and cultural landscapes; and
- Maintain individual trees and forest stand values to the maximum extent possible.

Although the 1991 Mount Rainier National Park Hazard Tree Management Plan emphasized a systematic approach, in practice, it was only partially implemented. Management has previously been accomplished on a case by case basis, and implemented annually, often under emergency conditions. Hazard trees have been treated as funding has allowed; otherwise, management of hazards has been accomplished through closure of public use areas. The Park has recently committed to funding a hazard tree manager position to implement the Plan, and has opportunities to fund hazard tree management activities in 2010.

Since 1991, there have been innovations in the identification and management of hazard trees that are best described in the updated Mount Rainier Hazard Tree Management Plan (2009). "The goal of hazard tree evaluation and hazard management is to strike a balance between maximizing public safety, minimizing costs and maintaining sustainability of the recreation resource (Harvey and Hessburg 1992)." In national parks, the identification and management of hazard trees is an important component of preserving park resources used by visitors. In Mount Rainier National Park, this means maintaining components of the forest ecosystems to the extent possible where developed recreation sites are located, while minimizing unacceptable risk to visitors.

Numerous court decisions have held that failure to conduct periodic hazard tree inspections and to correct reasonably detectable tree hazards exposes site managers to lawsuits and claims when damage to property or injuries or fatalities occur. In general, the public expects that public facilities will be as safe and as free of hazards as possible. A prudent, well-documented hazard reduction program can greatly reduce the liability of the site manager when injury or loss occurs.

Relationship to Laws, National Park Service Policy and Park Planning Documents (Authority)

Mount Rainier National Park is governed by its organic act (see *Introduction* above) and by the National Park Service Organic Act which identifies the purpose of national parks: ". . . to conserve the scenery and the natural and historic objects, and the wild life therein and to provide for the

enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

National Park Service Management Policies (NPS 2006)
8.2.5.1 Visitor Safety: *The saving of human life will take precedence over all other management actions as the Park Service strives to protect human life and provide for injury-free visits. The Service will do this within the constraints of the 1916 Organic Act. The primary—and very substantial—constraint imposed by the Organic Act is that discretionary management activities may be undertaken only to the extent that they will not impair park resources and values.*

While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service and its concessioners, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees. The Service will strive to identify and prevent injuries from recognizable threats to the safety and health of persons and to the protection of property… When practicable and consistent with congressionally designated purposes and mandates, the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education. In doing so, the Service's preferred actions will be those that have the least impact on park resources and values. . . .Park visitors must assume a substantial degree of risk and responsibility for their own safety when visiting areas that are managed and maintained as natural, cultural, or recreational environments.

4.4.2 Management of Native Plants and Animals: *. . .The Service may intervene to manage individuals or populations of native species only when such intervention will not cause unacceptable impacts to the populations of the species or to other components or processes of the ecosystem that supports them. The second is that at least one of the following conditions exists:* (only applicable conditions cited):
Management is necessary

- *to protect specific cultural resources of parks;. . .*
- *to accommodate intensive development in portions of parks appropriate for and dedicated to, such development;. . .*
- *to protect property when it is not possible to change the pattern of human activities; or*
- *to maintain human safety in cases when it is not possible to change the pattern of human activities.*

Or, removal of individuals or parts thereof. . .

- *meets specific park management objectives.*

4.4.2.4 Management of Natural Landscapes includes a provision for *rehabilitating areas disturbed by visitor use or by the removal of hazard trees*.

Pacific West Region Directive PWR-062: Hazard Tree Management (2009)
On February 16, 2006, a memorandum was issued converting the old Hazard Tree Western Region Directive and 1993 Guidelines for Managing Hazardous Trees to Pacific West Region Directive PWR-062. The memorandum stated that the directive would be updated at a later date. During the Pacific West Regional review of this Hazard Tree Plan/Environmental Assessment, it was determined that it did not meet the guidelines of PW-062 because the park (like other parks in the former Pacific Northwest Region) uses an 8-point rating system for inspecting potential hazard trees, whereas the directive calls for the use of a 7-point rating system. In fact, North Cascades National Park, Olympic National Park, and other parks now in the Pacific West Region, also use an 8-point system. These parks have extensive databases of hazard tree inspections using the 8-point system, while parks such as Yosemite National Park and Sequoia-Kings Canyon National Parks have extensive databases using the 7-point system. Both rating systems are based on professionally recognized criteria. In fact, the U.S. Forest Service uses the 8-point rating system. As a result, the Pacific West Regional Director suspended the PWR-062 Directive (1993) by memorandum dated March 22, 2007, pending a review and update. The Pacific West

Region Directive, PWR-062, Hazard Tree Management, was subsequently updated and signed on January 21, 2009, and supersedes the previous edition approved May 17, 1993 and the "1993 Western Region Guidelines for Managing Hazardous Trees" and any subsequent guidelines. The Directive is intended as a concise organized stand-alone document, provides objectives, updated terminology and references, and accepts the use of any professionally recognized rating system. This Directive provides guidance in the management of tree hazards and any other potentially hazardous vegetation which may injure people or damage property within park developed areas from the tree or parts of the tree failing.

NPS Director's Order 77: Natural Resource Management Guideline Handbook (NPS 1991)
Even though any tree or portion of a tree may present some degree of risk or hazard to visitors, employees and property simply by its proximity, in most cases only such trees that are determined to possess a structural flaw or structural defect may be deemed hazardous . . . The need for these plans arises from the responsibility of the NPS to reasonably protect visitors as invitees to parklands. Failure to do so could make the NPS liable. . .A deliberate effort by the NPS to manage for hazardous trees will reduce the risks and liability by avoiding vulnerability to claims of negligence or breach of duty.

Additionally, NPS 77 states that each park containing large vascular plants (usually trees) should prepare a hazard tree management plan (NPS 1991). Hazard tree plans are action plans and are considered to be part of the park's Natural and Cultural Resources Management Plan.

Federal Tort Claims Act of 1946 [28 USC 2671-80 and 1346(b)]
Under this act, the federal government can be liable for any loss of property, personal injury or death which was caused by the negligence of the government. The act waives the long-time doctrine of sovereign immunity which held that an individual could not sue the federal government. The Act is interpreted to mean that the landowner (NPS) can be held responsible for not taking reasonable care to avert harm to visitors and that reasonable care may take the form of action and/or warnings. In the case of hazard tree management, according to Harvey and Hessburg (1992), however, courts have held that informing the public of dangerous conditions does not eliminate liability when a fee is charged by the manager of the site. Furthermore, they state that responsibility to actively minimize tree hazards is roughly proportional to the degree of development at the site.

Mount Rainier National Park Natural and Cultural Resources Management Plan (NPS 1997)
Integrated Project Statement I-406.000: Reduction of Forest Tree Hazards identifies the need for an ongoing program of hazard tree management. This project statement calls for a program to

- Preserve and sustain healthy trees as components of the park's natural ecosystems, while treating or removing trees with discernible defects which represent risks to the public or property;
- Develop integrate and refine reliable and highly defensible standards for hazard tree identification and evaluation;
- Perpetuate a natural, regenerating forest ecosystem by allowing the accumulation of forest floor debris;
- Maximize the cost/benefit ratio of the hazard tree program, both in terms of property damage and money expended for inspection and implementation; and to
- Utilize an interdisciplinary approach toward hazard tree management through an open forum of discussion involving park management, other parks within the region, the U.S. Forest Service and the scientific community.

Cumulative Context of Tree Removal within Mount Rainier National Park

Trees within the park are managed or removed for a variety of reasons, including hazardous conditions, vista management, fire suppression, hazard fuel reduction and as needed for construction projects and during road maintenance. These park management actions result in actions that affect the structure and relative abundance of species within forested plant communities in the park and are considered in the cumulative impacts analysis section of this document.

Hazard Tree Management
Records documenting hazard tree removal are available as shown in Table 1.

Table 1: Hazard Tree Removal (reported by park staff)

Year	Approximate Number of Trees Removed	Year	Approximate Number of Trees Removed
1989	48	**1999**	Unknown
1990	2	**2000**	Unknown
1991	86	**2001**	70
1992	2	**2002**	86
1993	82	**2003**	0
1994	36	**2004**	51
1995	37	**2005**	4
1996	Unknown	**2006**	1
1997	6	**2007**	72
1998	Unknown	**2008**	33

As shown in Table 1, 616 hazard trees have been removed in the 16 of 20 years of record, or approximately 38 trees per year, ranging from 0 to 86 trees during the years for which records are available. Hazard tree removal operations during 2007 and 2008 used the full range of treatment options described in the hazard tree management plan. Most hazard tree identification is performed by park and other technical or contractual staff.

Vista Management/Historic Landscape Restoration
Historically, tree removal for scenic vista clearing occurred throughout the park. Managing scenic vistas of Mount Rainier, the Tatoosh Range and other views was an integral part of the design of park roads. Vista clearing continued somewhat regularly into the mid-1970s but has since been mostly discontinued. Recently, however, management of the Mount Rainier National Historic Landmark District (NHLD) has resulted in a draft Vista Management Plan for the Nisqually Road and limited vista clearing of small trees to re-establish views from historic structures has begun to occur. Protection and maintenance of the NHLD will continue to require vista clearing as appropriate to preserve views integral to the park's cultural landscapes. While individual environmental analysis of vista management proposals will continue to occur as needed; an Environmental Assessment is planned for a Parkwide Vista Management Plan.

Fire Management Activities, including Hazard Fuel Reduction and Fire Suppression
Tree removal in the park also occurs from fire management activities, including hazard fuel reduction and fire management. While hazard fuel reduction occurs in major developed areas and around structures, tree removal during fire suppression may occur throughout the park. Programmatic analysis of the park's five-year fire management program (Mount Rainier National Park Fire Management Plan/Fire Management Plan Environmental Assessment) has been approved (April 2005). Individual environmental analysis of projects which result in actions not anticipated by that plan will occur as needed.

Construction Projects
Although the park General Management Plan (2002) calls for no major new developments aside from the new Paradise visitor center, there are numerous replacement construction and rehabilitation projects going on at any given time that may result in tree removal and/or replacement. In the last few years, replacement of the White River garage, rehabilitation of the Paradise Guide House and construction of the Tahoma Woods Education Center, Longmire Emergency Operations Center, Tahoma Woods Apartments and White River Dormitory, as well as repair and rehabilitation of several park roads have resulted in localized tree removal. Other planned rehabilitation and construction projects include additional repair and rehabilitation of park roads (Stevens Canyon Road, Sunrise Road, etc.), rehabilitation of water and septic treatment systems, Mowich Lake Campground and Camp Muir rehabilitation, construction of the new Paradise visitor center, etc. As needed, individual environmental analysis, usually an environmental assessment, of the impacts of these proposed actions occurs.

Maintenance Activities
Trees affected by road and trail maintenance activities primarily include small trees that grow in roadside ditches (where woody material is removed through routine or cyclic maintenance), trees that overhang roads or trails, and trees that fall across roads or trails, as well as trees that grow near buildings and structures. Trees that grow in roadside ditches and along some roadside slopes are mowed or removed; trees that overhang park roads, trails and other structures are periodically limbed but may be removed if the overhang threatens the road. As appropriate, trees that fall across park roads are either placed back into adjacent forest or are removed and used for historic structure or trail rehabilitation. Trees growing near buildings or structures may be limbed if they overhang or removed if they affect foundations. Many of these activities are conducted as part of routine or cyclic maintenance and occur throughout the park, but primarily take place in snow-free times, especially during spring opening.

Often, the heavy snows and strong winds that occur throughout the winter cause trees to fail. The park road crew is responsible for removing winter damaged or felled trees blocking road access. The park trail crew removes winter felled trees from Wilderness. Neither action is considered part of the hazard tree program. This work would generally occur during the spring, but may occur as needed throughout the year. The length of time that chain saws would be used for each instance would be short (generally less than 30 minutes*).*

Definitions

Because the treatment of hazardous trees reduces what is considered an unacceptable degree of risk to park visitors, it is important to analyze what constitutes an unacceptable degree of risk and what alternatives exist for mitigating this risk.

Failure Potential: "Failure potential is estimated by examining a tree, determining the factors and conditions that contribute to failure or weakening, and estimating the likelihood that those factors and conditions will simultaneously occur before the next inspection period (Harvey and Hessburg 1992)." Failure potential takes into account the number and severity of defects, such as extent of rot, lean, percent of exposed or sprung roots, and crown condition, as well as environmental factors such as stand density, soil saturation and soil depth (and other soil conditions).

Hazardous Tree: "A hazardous tree is one that, because of a recognizable mechanical flaw, poses a threat to people or property (NPS 1991)." By definition, only those trees within striking distance of a target can be considered a hazard.

Negligence: Failure to take required action to adequately protect visitors. Liability for damages from hazardous trees commonly revolves around the determination of whether the NPS was negligent in its programmatic approach to managing hazardous trees (NPS 1991). There are four components of negligence according to NPS 77 (NPS 1991):

1) There must be legal duty or obligation requiring the agency to conform to a standard of conduct to protect the visitor against unreasonable risks. The responsibility of the agency to the visitor may generally be defined as using "ordinary and reasonable care to keep the premises reasonably safe for his visit and to warn him of any hidden danger" (Smith v. U.S. 1974).
2) There must be a failure (breach of duty) to meet the standard.
3) There must be an establishable [sic] connection between the action (or inaction) and the resulting injury or damage.
4) There must be a definable injury or damage level.

Acceptable Risk: Harvey and Hessburg (1992) define an acceptable level of risk when the following two conditions are met: 1) all components of hazard have been fully evaluated, and 2) failure and/or damage probability is very low.

Unacceptable Risk: Harvey and Hessburg (1992) define unacceptable risk when 1) the amount of defect indicates failure is likely, and 2) the potential for failure and the relationship to targets indicates damage is likely, and 3) target value is moderate or high.

Target: The object, structure or person that potentially may be hit or impacted by a falling tree or tree part (NPS 1991).

Target Value: The target value is based on the permanency of a structure and the type of structure or the frequency of use associated with a site. Sites with characteristic high and steady occupancy by persons and important structures may receive high target value ratings and are evaluated more regularly than those with low occupancy or few structures. The type of use and the frequency of the use are both taken into consideration in determining target value. The distance of the tree from the target, the frequency of use (seasonal vs. year round) and tree size (contributing to the degree of damage) can all influence this value.

II. ALTERNATIVES

ALTERNATIVE 1: No Action: Continue to Conduct Parkwide Hazard Tree Removal in Developed Areas According to the Mount Rainier National Park Hazard Tree Plan (1991).

This alternative would continue to result in:

- Systematic analysis and documentation of hazard trees using a rating system that places emphasis on removing trees in major developed areas;
- Two types of survey methods – *Complete* and *As Needed*;
- Several options for disposition of felled trees; and
- Replanting as determined appropriate (case by case).
- NEPA performed on a case by case basis (the 1991 plan was programmatic, and did not have a stand-alone NEPA document.

Survey Types and Locations
Conduct *Complete* (see Table 2) surveys in developed areas, campgrounds, trailheads, wilderness trailside camps and around historic structures in wilderness throughout Mount Rainier National Park. The same rating system would be used in frontcountry and wilderness, although a higher hazard rating would be needed to treat trees in Wilderness. Conduct *As Needed* (see Table 2) surveys along roads and pullouts and in minor developed areas.

Table 2: Hazard Tree Survey Types (Alternatives 1 and 2)

Type of Survey	Description
As Needed	Surveys prompted by notification of staff regarding trees that could be potential hazards (trees most likely noticed by staff include those that lean or are modified by recent storm damage, etc.
Complete	Thorough inspection of each tree within striking distance of a target, including previously rated trees. Trees are inspected at close range and from a distance.
Monitoring Walk-through	Visual scan for highly defective trees. Complete survey of individual trees (as deemed appropriate). Re-evaluation of trees rated 5 or higher.
Monitoring Drive-by	For roads. Same as monitoring walk-through but utilizing slow driving and pull-outs.
Photo Documentation	Digital photographs of roads used to determine which segments have highly defective trees and which require survey of individual trees. Comparison of lean and other defects possible.

Surveying Procedure
During *Complete* surveys, each tree within a size class great enough to damage a particular target would be rated on a scale of 1-7. In most developed areas (see Table 3), trees would be systematically rated (on a rotating schedule) every 3 years and treated according to the rating they received (with a range of treatments available). Some places, such as major developed areas, including administrative and concession facilities and housing would be monitored annually due to the number and value of targets present and the percentage of time that people occupy these areas. Individual requests by staff or visitors would also result in survey of identified areas or trees and, if appropriate, treatment. During predicted high winds, hazard tree warning signs would be posted on developed campground bulletin boards.

Assessment and Documentation
The following assessment and documentation forms would continue to be used:

Table 3: Tree Condition Assessment Criteria for Frontcountry and Wilderness (Alternative 1)

*A maximum total of four (4) points can be awarded for tree conditions items I-IV (See also Appendix 1)

I. A. Cat face, scar, frost crack or hollow butt present. B. Fruiting bodies or punk knots on hemlocks present. C. Tree declining or root rot present. D. Cut or exposed roots (>25 percent of root mass), inferior rooting system due to shallow or wet soil. E. Dead top or large dead branches (>5" in diameter), pronounced crooks, forked tops, volunteer tops, broken tops or any large branches (>8" in diameter) on hardwoods present. F. Insect frass or pitch tubes present. G. Mistletoe cankers/brooms or stem cankers present. H. Dead tree.	Assign 1 point, if any one or all conditions exist.
II. A. Old trunk scars (> or = to 50 years), scars > 2 square feet (or > 4 square feet on Douglas fir), open tension or frost cracks, hollow trunk (< or = to 6" of wood over ¾ circumference of tree). B. Numerous fruiting bodies (>5) of *Phellinus pini*, or any *Schweinitzii*, *Fomitopsis pinicola*, *F. officinalis*, *Echninodontium tinctorium*, *Fomes annosus*, *Phellinus weirii*, *Armillaria mellea*, or *Ganoderma appanatum* and others. C. Root disease is diagnosed with the presence of fading or chlorotic foliage, thinning crown, distress cone crop, or resin flow at the base of the tree. D. Cut or exposed roots (>50percent of root mass), or visible soil cracks around roots with shallow rooting or water saturated soil. E. Dead spike, broken or crooked top with large dead branches; large dead branches (>8" in diameter) on hardwoods. F. Carpenter ants or wood boring beetles (not bark beetles) with extensive boring. G. Mistletoe stem cankers present with ½ circumference of the swelling dead. H. Dead tree.	Assign 1 additional point, if any or all conditions exist.
III. A. Large open tension or frost cracks, hollow trunk (< or = to 6" or wood over ¾ circumference of tree, or < ½ radius over ¾ circumference on trees < 24" in diameter). B. More than 15 fruiting bodies of *P. pini*, or large fruiting bodies over 8" in diameter, or fruiting bodies of *P. pini, F. pinicola*, and *E. tinctorum* within 20 feet of the ground or covering more than 25 feet of trunk. Single conk of *F. officinalis* present. C. Root disease present with fruiting bodies of *F. annosus*, *P. weirri*, *A. mellea* and/or mycelial fans. D. Cut or exposed roots (>50percent) of root mass or root mass lifting on one side or disturbed soil showing. E. Large sections of loose bark, large detached branches or broken branches present. F. Dead tree.	Assign 1 additional point, if any one or all conditions exist.
IV. A. Tree is a hardwood (e.g. alder, maple or cottonwood). B. Tree leans more than 5percent and is susceptible to wind throw, saturated soils, shallow rooting, or is adjacent to a blow-down area. C. Tree leans more than 5percent and a structure of value is present.	Assign 1 additional point if any one of the conditions exists.

Table 4: Site Condition Evaluation for Frontcountry and Wilderness (Alternative 1)

I. Target of value other than a structure (historical or cultural)	Assign 1 point if present
II. a) Site commonly inhabited by 10 or less people, less than 100 percent of season b) Structure present with less than $50,000 value	Assign 2 points if either condition exists
III. a) Presence of major possessions (automobile, tent or trailer) or groups of 10 or more, more than 10 percent of time in season. b) Major structures present (homes, shops, visitor centers) more than $50,000 in value c) Infra-structure present (power lines, water systems, sewage treatment plants)	Assign 3 points if any one of the conditions exist

- **Hazard Tree Inspection Record /Database**
- (Data from the above analysis – Tables 3 and 4 – is recorded).

Treatment Objectives

As stated in the 1991 plan, the following objectives would continue to guide treatment decisions:
1) Preserve and sustain healthy trees as components of the park's natural ecosystems, while treating or removing trees with discernible defects that represent risks to the public or property;
2) Integrate and refine reliable and highly defensible standards for hazard tree identification and evaluation;
3) Help perpetuate a natural, regenerating forest through the accumulation of forest floor debris;
4) Maximize the cost/benefit ratio of the hazard tree program, both in terms of property damage prevented and money expended for inspection and implementation; and
5) Utilize an interdisciplinary approach to hazard tree management through an open forum of discussion involving park management, other parks within the region, the U.S. Forest Service and the scientific community.

Treatments

Treatment options would include:

- Removing or relocating the target,
- Site closure,
- Removing branches, and
- Removing the tree.

Table 5: Treatment Decisions (Alternative 1)

Frontcountry Areas	Remove, if hazard rating is greater than or equal to 5.
Wilderness Areas	Mitigate, if hazard rating is greater than or equal to 6. Some management action would be taken – not necessarily cutting of tree.

Disposition of Felled Trees
Removed trees and other natural forest residue (limbs, slash, plants and logs) would be treated according to Mount Rainier National Park Office Order 83-2 (revised 2002).

- Leave natural forest residue in place (preferred);
- Use natural forest residue for park purposes (compost, chipping, revegetation, historic structure rehabilitation, trail maintenance, campfire programs, heating public buildings);
- Locate road/trail fallen trees or limbs and brush back into forest;
- Place appropriate surplus wood for sale or provide as exchange to contractors (firewood or construction); and/or
- Use for alternative technology (chipping, revegetation, plant nursery, and haul to composting facility).

Revegetation
As appropriate, on a case-by-case basis, replanting would continue to be planned by park staff.

Trees Identified for Potential Treatment (Common to Alternative 1 and Alternative 2)
As shown in Table 6, due to a hiatus in systematic implementation of hazard tree monitoring and treatments a moderate number of trees are being considered for treatment following approval of the Hazard Tree Plan. In Alternative 1, once a decision had been made to remove the tree instead of removing or moving the target, the tree would be flush cut and primarily left to decay on site. In Alternative 2, a step down process to evaluate treatment would be used as shown in *Appendix 3*: Alternative 2 Hazard Tree Mitigation Decision Flowchart. The following evaluation criteria are encompassed in this step down process to decide on appropriate treatment(s):

- Can the target be moved?
- Can the site be closed temporarily until the hazard abates or permanently?
- Does the location in question have more than one hazard tree?
- Is the tree a nesting site or habitat for endangered species?
- Where is the defect? Can it be removed by limbing or topping?
- Does the tree have ecological, aesthetic or cultural values?
- Have more or less than 10 percent of the trees been removed from that location over time?
- How many trees have been removed during the preceding year?
- Do the treatments meet the terms of the (proposed) Finding of No Significant Impact (FONSI)?

Upon analysis of these factors, a separate decision would be made for each tree. If certain conditions are exceeded (see conditions of programmatic analysis noted in *Environmental Consequences* section), then individual analysis under the National Environmental Policy Act, Endangered Species Act and/or other federal laws could also be required.

Initial Trees Proposed for Treatment (Backlog)
Mount Rainier National Park has continued to evaluate hazard trees in the frontcountry and in some wilderness campsites pending analysis associated with the proposed new methodology and treatment. As a result, approximately 452 hazard trees (271 of which are 20 inches DBH or greater) have ratings of 7 and 8 and are considered for treatment (Table 6). The majority of the trees that require treatment (396 total and 236 >20 inches DBH) are in frontcountry developed sites.

Table 6: Backlog Trees Identified for Potential Treatment (Alternatives 1 and 2)

FRONTCOUNTRY DEVELOPED AREAS	Total Number* of Trees Proposed for Treatment	Number of Trees over 20 inches Diameter at Breast Height (DBH) Proposed for Treatment
Mowich Lake Campground	3	3
Tahoma Woods	1	1
Nisqually Entrance	0	0
Sunshine Point Campground	9	0
Kautz Creek Picnic Area	3	2
Nisqually to Paradise Road	0	0
Longmire Administrative Area	26	13
Longmire Campground	12	7
Cougar Rock Campground	43	20
Cougar Rock Picnic Area	21	14
Narada Falls	0	0
Paradise	7	5
Paradise Picnic Area	1	0
Box Canyon	2	0
Grove of the Patriarchs	1	1
Stevens Canyon Entrance	0	0
East side Highway (Highways 123 & 410)	1	1
Ohanapecosh Campground	191	114
Ohanapecosh Administrative Area	5	3
White River Entrance	28	15
White River Campground	22	14
Sunrise	1	1
Carbon River Entrance	0	0
Ipsut Creek Campground	21	19
Frontcountry Total	**398**	**233**
WILDERNESS CAMPS		
Lake George	21	17
Mystic Lake	23	7
Paradise River	4	4
Lake James Cabin	8	7
Wilderness Camp Total	**56**	**35**
GRAND TOTAL	**452**	**271**

*Numbers are approximate

ALTERNATIVE 2 (PREFERRED/ENVIRONMENTALLY PREFERRED): Conduct Systematic Evaluation of Trees in Developed Areas and in/near Backcountry and Wilderness Trailside Camps and Structures (including campgrounds, picnic areas, administrative, maintenance and housing areas, roads, pull-outs, nature trails, and backcountry cabins, shelters and fire look-outs)

General Description
As shown below and in Table 10, this Alternative would differ from Alternative 1 in some characteristics, but would also occur throughout the park, focusing on the same areas except as noted below. Implementation of Alternative 2 would result in an increase in the:

- Systematic analysis and documentation of hazard trees;
- Number of trees evaluated;
- Number of options for treatment;
- Types of surveys;
- Frequency of surveys; and in the
- Number of options for disposition.

The plan would also provide for:

- Some changes in the location of surveys;
- Surveys, as appropriate, following extreme weather events or other events, such as fires that could lead to increased defects in trees;
- A cumulative ecological impact study; and
- Replacement of trees in a one to one ratio.

Survey Types and Locations
Surveys would be conducted as described under Hazard Tree Management Zones in the Mount Rainier Hazard Tree Management Plan, and are summarized below

Frontcountry
Most hazard tree surveys would occur in frontcountry areas, due to the large number of people and facilities in these areas. Frontcountry areas fall into three main categories – campgrounds, administrative facilities and roads. Frontcountry campgrounds include: Sunshine Point, Cougar Rock, Ohanapecosh, White River and Ipsut Creek. Sunshine Point and Ipsut Creek were damaged or isolated during the November 2006 flood (future use of upper valley areas will be subject of a separate Carbon River Public Access Plan EA).

Administrative facilities include: Nisqually Entrance, Longmire, Paradise, Ohanapecosh, Sunrise, White River and the Carbon River Entrance. Infrastructure, such as water supply facilities and electrical transformers would also be surveyed, though less frequently. Roadsides generally would not be surveyed, due to the extensive length of roads and the low potential for striking a target. Exceptions to this include high use roads such as the section between the Nisqually Entrance and Longmire (open year round with a documented history of tree fall) and high use pullouts and overlooks.

Complete (Table 2) hazard tree surveys and treatments would be conducted in major and minor developed areas, campgrounds, wilderness trailside camps, and around wilderness historic structures and primary utilities infrastructure throughout Mount Rainier National Park. The same rating system would be used in frontcountry and wilderness. In most developed areas, trees would be systematically rated (on a rotating schedule) every 3 to 5 years and treated or monitored according to the rating they received (with a wider range of treatments available in this Alternative than in Alternative 1). Some areas, such as major developed areas, including administrative buildings, concession facilities and housing would be monitored annually.

Photo-documentation of hazard trees, survey sites and treatments would be used along roads and pullouts. High use roads, such as the Nisqually Road (Nisqually to Paradise) would also receive visual *Drive-By* and, as appropriate, individual tree evaluations. A photo database documenting all road segments within the park will be developed and updated every three to five years to determine which areas require surveys due to tree deterioration.

Carbon River-Ipsut Creek
This environmental analysis includes only general acknowledgement of conditions in the Carbon River valley. Access to this area has been curtailed since flood damage was incurred during 2006 and subsequent storms. A Carbon River Public Access planning process is currently being conducted to identify alternatives for future management of access to the Carbon River and other areas in the valley, consistent with the GMP Record of Decision (2002), which states: *"Close the Carbon River road to private vehicles when there is a major washout of the road and convert the Ipsut Creek campground to a walk-in/bike-in camping area."* The Carbon River Public Access Plan EA will detail the facilities and intended management criteria for facilities, trailheads, campgrounds, and picnic areas that will be available for future public use. Consequently, hazard trees in the Ipsut Creek Campground and Carbon River Entrance Station are identified in this analysis only for the purpose of assessing potential impacts. Actual treatment options would not be determined until later, in the Carbon River Public Access Plan EA.

Wilderness
In accordance with the Wilderness Management Plan, only the designated camps (where a wilderness permit is required for overnight occupancy) and administrative or historic sites in Wilderness would be inspected for hazard trees. These *Complete* hazard tree surveys would occur on a three-year rotating schedule. No hazard tree inspections would occur in other parts of the park's Wilderness. No inspections would occur along maintained trails within Wilderness. The same methodology (including point system) used for frontcountry areas would be applied to identify trees in the wilderness. As in Alternative 1, requests by staff or visitors, whether applicable in frontcountry or Wilderness, would result in surveys of identified areas or trees and, if appropriate, treatment. Additional monitoring may also be conducted in developed areas following high wind events and fires. Hazard tree removal in response to storm events and fire are beyond the scope of this EA, and would require separate NEPA.
Office Order 87-1: *Use of Mechanized Equipment in Wilderness* would be followed and a *Minimum Tool Justification* completed and submitted to the Superintendent for approval. See page 21 for a discussion of *Minimum Tool* use, and Appendix 7 for the Minimum Tool Requirement Justification form and background information.

Surveying Procedure
The proposed methodology uses a more refined system than Alternative 1, based on increased knowledge that brings the program more in line with the experience of other nearby land management agencies (USFS, Olympic and North Cascades national parks) in hazard tree management. This revision would lead to continuing evaluation of tree failure potential based on a thorough, systematic and repeatable identification and monitoring methodology. Under this Alternative, all trees within striking distance of a target (such as a building or developed campsite) would be evaluated and given a rating under the new, more comprehensive criteria. The rating would be based on a combination of potential for 1) tree failure, 2) striking a target, 3) serious damage to result, and 4) the value of the potential target(s) (Harvey and Hessburg 1992).

When surveying an area, all trees within striking distance of a target would be surveyed. Trees would be surveyed in a systematic manner. The sections of a tree to be surveyed include:

- the base of the tree for fungi, root damage, exposed roots, soil movement;
- the bole of the tree for wounds, cracks, fungi, leans, scars/callous tissue; and
- the top and branches for broken/dead tops, dead limbs, chlorosis (yellowing), mistletoe.

Assessment and Documentation
Hazard trees would be evaluated on a scale of 2 to 8, with 8 being the most hazardous rating. In this rating system, each tree could receive 1-4 points based on its failure potential (Table 7) and 1-4 points based on its target potential (Table 8). Trees with defects and a target would receive a total tree rating of 2-8, based on the sum of the target potential and failure potential. The rating analysis in Table 9 would be used to determine the appropriate mitigation.

Table 7: Determining Failure Potential (Alternative 2)

Failure Potential	Description of Affected Tree
1 = very low	Nearly sound tree. Not exposed to extreme weather.
2 = low	Minor defects in sheltered areas. Nearly sound trees in exposed areas.
3 = moderate	Highly defective trees in sheltered areas. Moderate defects in exposed areas.
4 = high	Highly defective trees in exposed area. Dead trees. Root disease. Roots with poor anchorage.

(Modified from Harvey and Hessburg (1992).

Table 8: Determining Target Value (Alternative 2)

Target Value	Type of Structure or Recreational Activity
1 = Negligible damage or injury possible	Any area used intermittently, including roads. No structures present.
2 = Minor damage possible	Day use picnic area, parking spurs, trailheads, developed nature trails, year-round roads
3 = Moderate damage possible	Campsites, parking areas, major road bridges, non-historic structures
4 = Extensive damage possible	Permanently occupied structures, concentrated use campgrounds, high value improvements (including restrooms, houses), campsites open year-round, historic structures, bridges

Table 9: Recommended Actions for Treatment of Hazard Trees (Alternative 2)

Rating	Hazard Level	Recommended Action
2	None	None
3-4	Low	None
5-6	Moderate	Monitor tree. Move target if possible or limbs if appropriate.
7	High	Move target, close site or remove top of tree or tree.
8	Very high	Move target, close site, or remove top of tree or tree.

The following forms would be used for documenting analysis of hazards:

- Hazard Tree Evaluation Form (*Appendix 5*) for each tree with a rating of 2 or more
- Hazard Tree Database entry (all trees rated are entered into this database)
- Tree Failure Form (*Appendix 6*) (each time, to the degree possible, that a tree falls within a developed area, road or onto a structure). This form may also be used to document trees that fall without targets (when known) to document the failure, disease, density of failure in a particular area, etc.

Treatment Decisions/Options

Systematic implementation of hazard tree monitoring and treatments would result in an approximate number of trees being considered for treatment. Annual lists of trees recommended for treatment would be prepared by the Hazard Tree Management Coordinator and the best treatment option selected based on a systematic evaluation of the advantages and disadvantages of the various options. Decisions regarding the appropriate treatment would be made individually (per tree). The following evaluation criteria are encompassed in this step-down process *(Appendix 3*: Hazard Tree Mitigation Flowchart*)* to decide on the appropriate treatment(s):

- Aesthetic value of the tree(s);
- Ecological value of the tree(s) (including consideration of contribution to riparian environments);
- Forest community structure;
- Number of trees to be removed from the area forest community;
- Feasibility of closing the site temporarily until the hazard abates (not part of Alternative 1);
- Feasibility of permanently closing the site (not part of Alternative 1);
- Feasibility of moving the target (based on the presence of movable or permanent structures and administrative or visitor use value as well as long-term plans for the site);
- Feasibility of mitigating the hazard by removing limbs or topping the tree (not part of Alternative 1);
- Feasibility of installing tree supports (for specimen trees) (not part of Alternative 1);
- Number of trees removed during the preceding year(s);
- Long-term plans for the site; and the
- Potential for damage that may result from topping or felling.

As noted above, the first treatment choice would be to move the target if possible. Second would be to close the site. If neither of these options is appropriate, then topping would be considered. The final choice would be to fell the tree. The Hazard Tree Management Plan flowchart is intended to show all possible considerations; however the majority of trees will fall into the top or remove category without requiring further decision-making steps.

Usually, topping or felling would be accomplished with a chain saw or cross cut saw. However, in cases where use of a chain saw is thought to be hazardous due to instability of the tree, then blasting may be used to accomplish the treatment.

In general, there are two avenues for treatment: a) remove the target – this is closure, temporary closure, relocation of site and b) treat the tree (which can be to remove a portion of the tree or the whole tree). Note that topping isn't necessary if it is a limb that is the hazard.

There would be a greater emphasis, in Alternative 2, on topping trees – where possible converting hazard trees to "habitat trees," by removing the unstable top portion of the tree and leaving the bottom portion as a standing dead tree (snag). As in Alternative 1, where large numbers of trees received high ratings, alternative actions, such as closure of that portion of the developed area (until the hazard abated) would be considered. In addition, wherever possible, a treatment action that involved removing the target would be considered for tree removal. In most cases during treatment, trees would be felled, where possible, into the forest and left in place.

The annual list of hazard trees would be reviewed each year by an interdisciplinary team to ensure that proposed treatments do not adversely affect park resources and are in conformance with agency consultation (USFWS, SHPO) on the Hazard Tree Plan. In addition, the following treatments would require additional interdisciplinary analysis and/or individual documentation:

- Permanent or long-term (more than one season) closure of park administrative or visitor facilities;
- Proposed relocation of target, such as buildings, requiring extensive cost and/or planning
- Removal of more than 10 percent of the total number of trees from a specific location (at one time or over time);
- Treatments that do not meet the terms of the determination of either *No Effect* or *May affect, not likely to adversely affect* for northern spotted owls or marbled murrelets as a product of this consultation;
- Removal of known nesting site of a rare, threatened or endangered species; and/or
- Removal of specimen trees or trees with a DBH of 40 or more inches.

Upon analysis of these factors, a separate decision would be made for each tree. If certain conditions are exceeded, such as actions that cause more environmental impact or exceed the parameters provided in the mitigation measures (for example, timing of hazard tree removal relative to spotted owl nesting time periods), then individual analysis under the National Environmental Policy Act and/or the Endangered Species Act could be required.

Consultation with Other Agencies
Under this Alternative as part of the hazard tree treatment decision process, the U.S. Forest Service, Wenatchee National Forest District Pathologist or an equivalent expert would be consulted when large numbers of trees have been rated as 7 or 8 in an area, to verify the ratings. In addition, as appropriate, consultation with other park staff (including the park wildlife ecologist, plant ecologist, historical architect and historical landscape architect or equivalent experts) and other agencies, such as the USFWS and SHPO would occur to ensure that proposed treatments do not have effects on park resources not disclosed in this Environmental Assessment.

Backcountry/Wilderness Hazard Tree Treatment
In addition to the criteria listed above, additional steps are required for the treatment of hazard trees in Wilderness. When cutting trees is determined necessary, the minimum tool necessary to accomplish the task would be employed. If mechanized equipment is proposed, then Office Order 87-1: *Use of Mechanized Equipment in Wilderness* would be followed and a *Minimum Tool Justification* completed and submitted to the Superintendent for approval. Extra care would be taken to lessen the visual impacts of the cuts. Whenever possible, stumps would be flush cut, naturalized and logs arranged with cuts facing away from view. All trees cut in Wilderness would be left in place to decay naturally. Small limbs and debris would be placed away from the immediate vicinity of camps to deter campfires (illegal in park Wilderness). Appendix 7 contains the Minimum Tool Requirement Justification form and background information.

Hazard Tree Treatment Implementation
Upon completion of inspections and decision-making, the Hazard Tree Management Coordinator would work with the park's Contracting Officer or Roads Supervisor to coordinate treatments. Park felling operations would also take place using road crew staff as available. The Hazard Tree management Coordinator, as the Contracting Officer's Technical Representative, would be present during contracted or park felling operations to ensure that the trees to be felled have been properly identified and are removed in a safe and appropriate manner and that the requirements of the contract and other park mitigation measures are fulfilled.

Timing
Tree removal would generally be accomplished during late fall (after September 30) after closure of most visitor facilities. Fall removal is necessary to minimize potential noise disturbance to northern spotted owls or marbled murrelets during their nesting season. Fall removal also has the benefit of minimizing the potential to disrupt visitor experience because visitation typically drops off significantly after Labor Day weekend. Trees that have fallen across roads in winter

would be removed as noted above. Campgrounds would be reassessed for hazard trees prior to spring opening to document any winter damage. If new hazard trees are identified, treatment options would be evaluated as noted above. If a tree requires immediate treatment during spring opening (March to June) the park Wildlife Ecologist, and other staff consultation would occur as appropriate.

Disposition of Felled Trees
All hazard trees felled within the park would be recycled into the ecosystem, except where leaving them in place would inhibit use of the area, create unacceptable fuel loads, or when they have been approved for use in maintenance / cultural resources projects. Felled trees would be left on site and would not be cut into sections, unless it is necessary to move the logs. Sections of a tree creating an obstacle within a campsite or developed area would be moved to the edge of the site. In situations where large numbers of trees have been felled, the Plant Ecologist and the Hazard Tree Management Coordinator would determine an appropriate number of trees to be left on site.

Removed trees and other natural forest residue (limbs, slash, plants and logs) not left in place, would be treated according to Mount Rainier National Park Office Order 83-2 (revised 2002). The options that would be considered from this and other guidance include:

- Leave natural forest residue in place (preferred);
- Use of natural forest residue for park purposes (compost, chipping, revegetation, historic structure rehabilitation, trail maintenance, campfire programs, heating public buildings ,engineered log jams);
- Locate road/trail fallen trees or limbs and brush back into forest;
- Placement of appropriate surplus wood for sale or provided as an exchange to contractors (for firewood or construction, respectively); and/or
- Use for alternative technology (chipping, revegetation, plant nursery, and haul to composting facility).
- Dispose of through agreement with other state, federal or tribal governments (as approved by the Superintendent). Appropriate surplus wood may be made available for use by Native American Tribes traditionally affiliated with the park.

Site Rehabilitation/Monitoring/Revegetation
Consistent and long-term removal of hazard trees may result in changes to plant community structure, net primary productivity, wildlife activity and aesthetic value. The nature of high use recreational areas, such as campgrounds suggests that trees will continue to be impacted and become structurally unstable *over time.* If revegetation efforts are not made in areas where large numbers of hazard trees are treated, in time these areas could undergo changes in forest community structure and composition, perhaps eventually degrading into another community type.

Because specific revegetation to compensate for past hazard tree removal has not been conducted, revegetation may initially occur at larger ratios to compensate for previous hazard tree removal and then at a one-to-one ratio, as appropriate. For each tree felled in frontcountry areas, generally a new tree (appropriate to the site conditions and forest community) would be planted from source genetic material. With few exceptions trees would be replaced in-kind with respect to species and general location. The park Horticulturist would be consulted to obtain replacement specimens for areas where large numbers of trees have been felled. Only species appropriate to the impacted area would be used. For example, in many of the park campgrounds, western red cedar (*Thuja plicata*) is an ideal candidate due to its high degree of disease resistance and structural stability, however, a variety of species would be planted to maintain biodiversity. Generally a minimum one-to-one replacement would be used; for each tree felled, a new tree would be planted. No replanting is currently planned for wilderness trailside camps, where human disturbance is less frequent (often seasonal) and fewer trees are expected to be removed.

Ecological Analysis
As shown in Table 14 (within *Environmental Consequences*), most park developed areas occupy less than one percent of the total forest community type for a given watershed. To further ensure that park hazard tree management does not result in significant alteration of forest community types, particularly near major developed areas within the park, an ecological study has been initiated and will continue. Better understanding of the relationship between forest conditions in developed versus undeveloped areas will result in better management of the park hazard tree program, particularly as it relates to management of potential cumulative effects in park forests.

Trees Identified for Potential Treatment (Common to Alternatives 1 and 2)
(*See description in Alternative 1 above and Table 6*)

Alternatives Considered but Dropped

Under the National Environmental Policy Act (NEPA) alternatives may be eliminated from detailed study based on the following reasons [40 CFR 1504.14 (a)]:

- Technical or economic infeasibility;
- Inability to meet project objectives or resolve need for the project;
- Duplication of other less environmentally damaging alternatives;
- Conflicts with an up-to-date valid plan, statement of purpose and significance, or other policy; and therefore, would require a major change in that plan or policy to implement; and
- Environmental impacts too great.

The following alternatives or variations were considered during the design phase of the project, but because they did not meet one of the above criteria, they were rejected.

1. Do Not Conduct Systematic Hazard Tree Evaluation in Developed Areas
Under this Alternative, the park would not undertake a comprehensive program of hazard tree identification, assessment and monitoring. Potentially hazardous trees would remain in place, posing a potential threat to visitors and historic structures in developed areas. This Alternative could give the park an unacceptable degree of liability for injuries, damage or death that resulted from the park's not managing hazard trees. Selection of this Alternative would violate NPS Management Policies and the Natural Resources Management Guideline (NPS-77).

2. Do Not Conduct Systematic Hazard Tree Evaluation along Roads
This alternative was rejected because the four fatalities that have occurred in the park related to trees falling have been along roads and because of the liability incurred similar to #1 above.

3. Do Not Conduct Systematic Hazard Tree Evaluation in Wilderness
NPS-77 directs parks to evaluate hazard trees in wilderness trailside camps and near occupied wilderness historic structures. This alternative would not comply with that guideline.

4. Conduct Complete Evaluations along Roads and Pullouts
This alternative was rejected because of the significant increase in the amount of staff that would be required to implement the hazard tree program during the park's short snow-free season. It was also rejected because it is generally accepted among land management agencies that hazard tree management does not include complete evaluations along roads. This alternative would also require the park to conduct surveys and to remove trees between the wilderness and non-wilderness boundary, including affecting trees located in wilderness (the wilderness boundary is generally located 200 feet from the centerline of paved roads and 100 feet from the centerline of unpaved roads and park trees are often over 200 feet tall). Systematic removal of trees adjacent to roads would also result in an adverse effect on the Mount Rainier National

Historic Landmark District and likely in wilderness as well. In addition, many known activity areas associated with endangered bird species are located alongside roads. As a result, this alternative would likely have resulted in adverse effects on endangered species and wilderness.

5. Conduct Systematic Evaluation of Trees along Wilderness Trails
This alternative was rejected because of the immense amount of staff time that would be required to systematically evaluate trees along 260 miles of trails, most of which are in wilderness, and because it is not essential to the management of park wilderness and therefore would not meet the intent of the Wilderness Act.

6. Increase Frequency of Monitoring
This alternative was rejected because of the significant increase in the amount of staff and therefore cost of the program that would be required to implement the hazard tree program during the park's short snow-free season. There is a slow rate of change in hazard rating unless there is an unusual event. Most agencies do not conduct more frequent monitoring because it simply would be cost ineffective.

7. Evaluate Only Trees Reported by Park Staff or Visitors
This alternative would result in a non-systematic hazard tree program that would significantly increase the liability of the National Park Service (see # 1 above). This alternative would also leave the judgment to untrained staff unlikely to detect most hazards and too often report trees that are not hazards.

8. Treat Every Tree Rated 5 or Higher
This alternative would result in a large number of trees being treated and/or removed that currently contribute to wildlife habitat and forest structure. This alternative was rejected because it would not meet the Hazard Tree Management Program goal of maintaining a balance between mitigating hazard trees and ecosystem preservation. Many trees rated 5 or 6 are stable despite some defects, and may never progress to a 7 or 8 rating and therefore may continue (with annual monitoring) to contribute to the park's ecosystem for decades.

Environmentally Preferred Alternative

In accordance with Director's Order-12, *Conservation Planning, Environmental Impact Analysis, and Decision-making* and CEQ (Council on Environmental Quality) requirements, the NPS is required to identify the "environmentally preferred alternative" in all environmental documents, including Environmental Assessments. The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act (NEPA) of 1969, which is guided by the CEQ). The CEQ (46 FR 18026 - 46 FR 18038) provides direction that the "environmentally preferable alternative is the alternative that would promote the national environmental policy as expressed in NEPA's Section 101," including:

1) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2) Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3) Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
4) Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
5) Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
6) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources (NEPA Section 101(b)).

Generally, these criteria mean the environmentally preferred alternative is the alternative that causes the least damage to the biological and physical environment and that best protects, preserves, and enhances historic, cultural, and natural resources (46 FR 18026 – 46 FR 18038). Although both Alternative 1 and Alternative 2 would meet these criteria, Alternative 2 would best meet them because it would only treat trees in the highest categories and because it would expand a tree and vegetation replacement strategy and initiate long-term ecological analysis.

Table 10: Alternative Comparison Chart

CRITERIA/LOCATION	ALTERNATIVE 1	ALTERNATIVE 2
Description of Alternative	**Alternative 1**: (No Action) Continue to Conduct Systematic Hazard Tree Surveys and Treatments in Developed Areas according to the 1991 Mount Rainier National Park Hazard Tree Management Plan.	**Alternative 2 (Preferred)**: Conduct Systematic Hazard Tree Surveys and Treatments in Developed Areas and developments in Wilderness Areas according to the 2009 Mount Rainier National Park Hazard Tree Management Plan
Trees Rated		
	Each tree within a size class great enough to damage a particular target	All trees within striking distance of a target
Rating System		
Criteria	Tree Condition: 4 points Site Condition: 3 points	Target Value: 4 points Failure Potential: 4 points
Highest Rating	7 points	8 points
Application to Wilderness	Same rating system used	Same rating system used
Points Needed for Monitoring	--	5 or 6
Points Needed for Treatment	Wilderness = 6-7 of 7 Frontcountry = 5-7 of 7	Wilderness = 7-8 of 8 Frontcountry = 7-8 of 8
Treatment Options		
	Remove or relocate target Site closure (does not distinguish between permanent or temporary) Remove branches Remove tree	Remove or relocate target Permanent site closure Temporary site closure (natural mitigation or park intervention) Install tree support Top tree Remove branches Remove tree
Treatment Decision Making	Hazard Tree Coordinator	Decision Making Flow Chart
Types of Surveys		
	Complete	Complete Monitoring Walk-through Drive-by Photo-documentation
Type and Frequency of Surveys		
Campgrounds (Cougar Rock, Ipsut Creek, Ohanapecosh, Sunshine Point, White River including associated facilities such as amphitheaters)	Complete 3 years	Complete 3-5 years Annual monitoring
Picnic Areas (Box Canyon, Cougar Rock, Ipsut Creek, Ohanapecosh, Paradise, Sunshine Point, Sunrise, Tipsoo Lake)	Complete 3 years	Complete 3-5 years Annual monitoring
Trailheads	Complete 3 years	-- Some included as part of road pullout surveys
Major Developed Areas (Carbon River, Nisqually Entrance, Longmire (including Longmire Campground), Ohanapecosh, Paradise, Sunrise, Tahoma Woods, White River Entrance)	Complete Annual Including employee housing, administrative facilities and concession facilities	Complete 3-5 years Annual monitoring
Minor Developed Areas (Box Canyon, Mowich Lake, Tipsoo Lake, Stevens Canyon Entrance)	When reported	Complete 3-5 years Annual monitoring
Primary Utilities Infrastructure (water and wastewater treatment, water storage tanks, water supplies, power lines, transformers)	Complete 3 years No inspection of overhead lines	Complete 5 years
Forest Nature Trails (Carbon River Boardwalk, Twin Firs, Trail of the Shadows, Grove of the Patriarchs, Nisqually Vista, White	--	Complete 3 years

CRITERIA/LOCATION	ALTERNATIVE 1	ALTERNATIVE 2
River Picnic Area)		
Roads (including road bridges)	When reported	Photo-documentation 3 years Individual trees as appropriate or reported Annual drive-by monitoring
Nisqually Road	When reported	Photo-documentation 3 years Annual drive-by monitoring
State Route 123	When reported	Photo-documentation 3 years Annual drive-by monitoring
State Route 410 (Mather Memorial Parkway	When reported	Photo-documentation 3 years Annual drive-by monitoring
Stevens Canyon Road	When reported	Photo documentation 3 years Annual drive-by monitoring
Overlooks High Use Pullouts	When reported	Complete 3-5 years
Backcountry/Wilderness Camps	Complete 3 years Minimum tool used Stumps flush cut, naturalized, log cuts out of view. Brush removed from camp vicinity to prevent use for fires.	Complete 5 years Minimum tool used Stumps flush cut, naturalized, log cuts out of view. Brush removed from camp vicinity to prevent use for fires.
Backcountry/Wilderness Structures	Complete 3 years Minimum tool used Stumps flush cut, naturalized, log cuts out of view.	Complete 5 years Minimum tool used Stumps flush cut, naturalized, log cuts out of view.
Other Wilderness	--	--
Documentation	Hazard Tree Inspection Record, including Map Hazard Tree Database	Hazard Tree Evaluation Form Tree Failure Form Hazard Tree Database
Disposition of Felled Trees	According to Office Order 83-2 (all alternatives) • Leave natural forest residue in place • Use natural forest residue for park purposes (compost, chipping, revegetation, historic structure rehabilitation, trail maintenance, campfire programs, heating public buildings) • Locate road/trail fallen trees or limbs and brush back into forest • Place appropriate surplus wood for sale or provide as exchange to contractors (firewood or construction) • Use alternative technology (chipping, revegetation, plant nursery, haul to composting facility) • Dispose of through agreement with local, federal or tribal governments.	Same as Alternative 1
Ecological Impact Study	--	Initiated
Replanting	As planned by Botanist and Landscape Architect	Frontcountry: generally one to one Wilderness: none
Following Wildland Fire Use or Suppression Activities	--	As necessary where fire results in potential hazards Survey type will be based on target type
High Wind Conditions	Results in warning signs on frontcountry developed campground bulletin boards	Results in monitoring surveys following event
Initially Proposed Treatments	452 trees	452 trees

III. IMPACT TOPICS

Impact topics were developed to address potential environmental, social and economic impacts that might result from the Hazard Tree Management Program as identified by the public, the NPS, other agencies and to address federal laws, regulations, and NPS management policies and guidelines.

Public Scoping Comments

To aid in internal scoping, a press release dated June 27, 2003 was sent to, the park's environmental analysis mailing list, including individual members of the public, local, state and federal governments, six tribes, and non-governmental organizations. The press release was published in several local papers including the Tacoma News Tribune, The Dispatch (Eatonville), the Seattle Post Intelligencer, Associated Press (Seattle),the Eagle News, Tri-City Herald, The Columbian, the Federal Way News, Issaquah, Methow Valley, Coastal Media, Leavenworth, Central Kitsap, Highway Shopper (White Pass), PT Rider (Port Townsend),local television and radio media, and more (see project file). Responses were received from the Squaxin Island Tribe and Northwest Ecosystem Alliance. These responses stated that the plan should:

- Define what constitutes a hazardous tree;
- Identify the level of acceptable risk for park visitors;
- Identify the purpose and need for revision to the plan;
- Ensure thorough analysis and sound science when identifying hazardous trees;
- Conduct independent and systematic evaluation of trees (not as a cluster or stand);
- Consider indirect impacts such as wind throw and sunscald;
- Use mitigation that focuses on removing the target rather than the tree or trees;
- Use treatments that reduce the hazard but save the tree;
- Avoid indirect impacts to adjacent trees;
- Prevent impacts by design of recreation facilities;
- Restore areas where hazard trees are removed by replanting;
- Use trees removed for on or off-site restoration;
- State the relationship to fire suppression measures to hazard tree management; and
- Consider Medicine Creek Treaty tribe issues.

These concerns have been integrated into this Environmental Assessment and the Mount Rainier Hazard Tree Management Plan (2009).

Soils, Vegetation and Wildlife: The National Environmental Policy Act (NEPA) calls for examination of the impacts on the components of affected ecosystems. NPS policy is to protect natural resources, including the natural distribution, abundance and diversity of the park's ecosystem. Consequently evaluation of impacts to soils, vegetation and wildlife are considered.

Special Status Species and Habitats: The Endangered Species Act requires an examination of impacts to federally threatened or endangered species. NPS policy requires that impacts to unlisted sensitive or rare species are also considered. Initial informal consultation with the U.S. Fish and Wildlife Service (USFWS) (dated July 11, 2003) identified a number of species which are considered federally threatened or endangered as potentially occurring within the park. In addition, there are a variety of plants, mammals, birds, amphibians, reptiles, fish and insects that are not listed, but which are considered sensitive or rare that may occur within the park.

Cultural Resources (including archeology, historic structures, cultural landscapes and ethnographic resources): Consideration of cultural resources is required under Section 106 of the National Historic Preservation Act, as amended, and the 1995 Programmatic Agreement between the National Park Service and the National Conference of State Historic Preservation Officers and the Advisory Council on Historic Preservation. In addition, the Archeological Resources Protection Act and other legislation and policy direct additional consideration of potential effects on a variety of cultural resources, including historic properties, and archeological sites.

Visitor Use/Public Health and Safety: Because the treatment of potentially hazardous trees reduces what is considered an unacceptable degree of risk to park visitors, it is important to analyze what constitutes an unacceptable degree of risk and what alternatives exist for mitigating this risk.

Wilderness: The Wilderness Act and the Washington Parks Wilderness Act require consideration of effects of park actions on designated wilderness in Mount Rainier National Park. The park's Proposal Planning and Review/Minimum Tool processes are the primary means of considering project effects on wilderness, including the use of the minimum tool process.

Impact Topics Dismissed

Some impact topics mandated by law or executive order are described below, but have been dismissed from further consideration because impacts may be either non-existent or negligible.

Air Quality: Mount Rainier National Park is designated a Class I area under the Clean Air Act (1977). Class I areas are afforded the highest degree of protection under the Clean Air Act. Any impacts to air quality, therefore, are considered potentially detrimental. In contrast to surrounding metropolitan areas, air quality within the park is usually good; however, high ambient sulfate levels, low pH levels of airborne water droplets, and high ozone levels have all been documented. Activities such as campfires and the operation of vehicles and equipment cause local temporary air quality degradation, although stationary and mobile emissions from the Puget Sound area are the major sources of pollution near the park. Class I designation allows for minimal air quality deterioration. Any impacts to air quality as a result of the proposals in this Environmental Assessment would be negligible, short-term and localized. As a result this issue is not analyzed further.

Climate Change: Executive Order 13423 calls for Federal agencies to reduce greenhouse gas (GHG) emissions on an agency-wide basis. The executive order does not suggest that every individual agency project should result in a reduction of greenhouse gas emissions from baseline conditions. Although this project would result in GHG emissions, those emissions are minute in comparison to the park baseline (less than 0.95% of the 2006 baseline). It is reasonable to term such a contribution relative to park baseline emissions as negligible or minor. Although it is true that anthropogenic climate change represents a potential threat to park resources and values, GHG emissions from sources throughout the planet integrate and collectively contribute to climate change and its related effects on resources. As such, emissions associated with the project do not represent an appreciable contribution to the cumulative effect of global GHG emissions, i.e., climate change (pers. comm. Tom Flanagan, NPS Environmental Quality Division, 2009).

Hazard tree management is expected to have a negligible effect on carbon emissions, in part because individual trees are already in a state of decline, and are on balance not acting as carbon sinks. Trees would not be removed from the park, so net decomposition would continue to occur in place. The space previous crown area occupied by the trees would regenerate, whether through manual planting or natural regeneration – in many locations the removal of the trees would release existing shrubs and small trees, resulting in a localized increase in growth rates, and a local reduction in respiration and decomposition rates. The rate of change and localized response depends on many factors, including the characteristics of the tree to be removed, the composition of surrounding vegetation, climate, elevation, latitude, aspect, etc. Finally, the number of hazard trees and area treated is a small fraction of the total forested area of the Park. Any contribution toward green house gas emissions through the loss of carbon sequestration opportunities is expected to be immeasurable.

Geology and Geological Hazards: The National Environmental Policy Act (NEPA) requires the analysis of impacts on all affected components of the human environment (including natural, cultural and social impacts). Analysis of geological processes and hazards is also required under Management Policies (2001). Based on the subject of this Environmental Assessment, no potential impacts to geological processes or changes in geological hazards would occur.

Water Quality and Quantity: Because the Alternatives in this Environmental Assessment do not affect the quantity of water (no water withdrawal is proposed) and would have only negligible, temporary and localized effects on water quality as a result of soils potentially loosened by felling activities, and because tree removal is isolated and would not extend over a large area, whole stands or whole watersheds, any potential for water quality impacts would be negligible.

Wetlands: Executive Order 11990 requires that impacts to wetlands be addressed. Because no jurisdictional wetlands will be affected as a result of the proposals in this Environmental Assessment, impacts to wetlands would not occur and are therefore not considered further in this Environmental Assessment.

Floodplains: Executive Order 11988 requires that impacts to floodplains be addressed. Although some portions of developed areas affected by the proposals in this Environmental Assessment are considered to be floodplains, this Environmental Assessment does not describe new construction in these areas and ongoing use of existing areas, including developed campgrounds is considered an excepted action under National Park Service implementation guidelines for this Executive Order. As a result analysis of the unlikely effects of the proposed actions on floodplains is not discussed further.

Socioeconomics: Although the proposals contained within this Environmental Assessment would likely result in some very limited economic benefits if contractors were selected for hazard tree removal, the small number of trees removed each year would not result in a gain that could be measured against the local or regional economy. Therefore this impact topic is not analyzed further.

Environmental Justice: Executive Order 12898: “General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” requires Department of Interior Agencies to analyze and evaluate proposals with respect to the impacts on these populations. None of the alternatives herein would have potential to differentially affect minority or low-income populations; therefore this topic is not analyzed further.

IV. AFFECTED ENVIRONMENT

Eighty-three percent (196,181 acres) of Mount Rainier National Park lies in Pierce County and 17 percent (39,444 acres) is in Lewis County. The elevations of the park range from about 1,400 feet above sea level at the Tahoma Woods Administrative Site to 14,410 feet at the summit of Mount Rainier.

The focal point of the park is the towering, snow and ice-covered volcano, a prominent landmark in the Pacific Northwest. The base of the volcano spreads over an area of about 100 square miles. Mount Rainier is the second most seismically active and most hazardous volcano in the Cascade Range. The 26 major glaciers that flank the upper mountain cover 35 square miles. Below, steep glaciated valleys and ice carved peaks dominate the park landscape. The Carbon, Mowich, White, West Fork White, Nisqually, South Puyallup, and North Puyallup rivers and their tributaries carry water from Mount Rainier to the Puget Sound. The Ohanapecosh flows into the Cowlitz River before exiting the park enroute to the Columbia River.

Mount Rainier's scenic landscapes – including the dense lower old-growth forests, the magnificent display of subalpine wildflowers, mantling the Mountain itself – have attracted people for generations. The mountain is a destination for snow and ice climbers throughout the world. About 2.0 million people visit the park annually, with most visitation (75 percent) occurring between June and September.

Soils

The park contains areas of high elevation solid rock and talus slopes with virtually no soil to low elevation glacial valleys with well-developed organic soils. Hobson (1976) classified park soils into four types as follows: tephra soils (pyroclastic deposits identified by individual ash layers); colluvial soils (coarse, unconsolidated soils of mixed parent materials); alluvial soils (river- or glacially-deposited soils); and mudflow soils (surface or subsurface parent materials resulting from volcanic mudflows). Beyond the work done by Hobson, however, there is little information on park soils, although Franklin *et al*. (1988) described the following soil characteristics.

Tephra soils are common in forest communities and are comprised of volcanic parent materials (ash, pumice, etc.). They are typically coarse sands or gravelly sandy loams with less than 10 percent organic material.

Colluvial soils are the dominant soil group in the park (Franklin *et al*. 1988). They are generally unstable, rapidly drained and consist of coarse, unconsolidated mixed parent materials. They are found on slopes at all elevations, but especially on steeper slopes and south facing aspects.

Alluvial soils occur in major river valleys, along streams, wet benches and alluvial slopes and fans. They consist of coarse undifferentiated fine or very fine sands. Alluvial deposits are of varying thickness and texture.

Mudflow soils result from lahars (volcanic debris flows). They are characterized by poorly sorted materials and often include rounded rocks and boulders intermixed with fine loamy sands, cobbles and gravel.

Vegetation

Park vegetation is diverse, encompassing three ecological zones: the alpine zone, the subalpine zone and the forest zone.

The forest zone blankets the lower elevations of the Mountain's flanks, occupying about 58 percent of the park, and is dominated by the following coniferous tree species: western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), noble fir (*Abies*

procera), grand fir (*Abies grandis*), subalpine fir (*Abies lasiocarpa*) Alaska yellow cedar (*Chamaecyparis nootkatensis*), Engelmann spruce (*Picea engelmannii*), western white pine (*Pinus albicaulis*), and lodgepole pine (*Pinus contorta*). Deciduous trees include: bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), and black cottonwood (*Populus balsamifera*), etc.

Franklin *et al*. (1988) identified the following major forest zones:
Tsuga heterophylla or Western Hemlock Zone
Abies amabilis or Pacific Silver Fir Zone
Tsuga mertensiana or Mountain Hemlock Zone.
These were further divided into 14 plant associations and 5 community types in the park (Franklin *et al*. 1988) as noted in Appendix 3, Forest Plant Associations, Community Types and Phases.

Common forest plants include: salal (*Gaultheria shallon*), seven species of huckleberry (*Vaccinium* sp.), white-flowered rhododendron (*Rhododendron albiflorum*), kinnikinnick (*Arctostaphylos uva-ursi*), twinflower (*Linnaea borealis*), Indian-plum (*Oemleria cerasiformis*), salmonberry (*Rubus spectabilis*), thimbleberry (*Rubus parviflorus*), five-leaved bramble (*Rubus pedatus*), dwarf bramble (*Rubus lasiococcus*), devil's club (*Oplopanax horridus*), red-flowering currant (*Ribes sanguineum*), sitka willow (*Salix sitchensis*), cascara (*Rhamnus purshiana*), Sitka alder (*Alnus crispa*), beaked hazelnut (*Corylus cornuta*), vine maple (*Acer circinatum*), oregon grape (*Mahonia nervosa*), false solomon's seal (*Smilacina racemosa*), false lily of the valley (*Malanthemum dilatatum*), queen's cup (*Clintonia uniflora*), bear grass (*Xerophyllum tenax*), western coralroot (*Corallorhiza maculata*), foamflower (*Tiarella trifoliata*), yellow wood violet (*Viola glabella*), white-veined wintergreen (*Pyrola picta*), pipsissewa (*Chimaphila umbellata*), vanilla leaf (*Achlys triphylla*), inside-out flower (*Vancouveria hexandra*), redwood sorrel (*Oxalis oregana*), wild ginger (*Asarum caudatum*), bunchberry dogwood (*Cornus canadensis*), skunk cabbage (*Lysichiton americanum*), sword fern (*Polystichum munitum*), deer fern (*Blechnum spicant*), and lady fern (*Athyrium filix-femina*).

From about 5,000 feet to tree line and covering about 23 percent of the park is the subalpine zone, characterized by scattered stands of subalpine fir, heather and herbaceous meadows. Park subalpine meadows are well known for their beauty and diversity. These meadows can be divided into the following types: heather-huckleberry, black sedge, green fescue, lush herbaceous and "rawmark" or early successional. The distribution patterns of these plant communities are largely determined by the depth and duration of snow pack (Franklin *et al.* 1988).

Common subalpine plants include: white mountain heather, pink mountain heather, red mountain heather (*Phyllodoce glanduliflora*), kinnikinnick, sitka mountain ash (*Sorbus sitchensis*), false azalea (*Menziesii ferruginea*), false hellebore (*Veratrum viride*), avalanche lily (*Erythronium montanum*), Tolmie's saxifrage, Newberry's fleeceflower (*Polygonum newberryi*), bistort (*Polygonum bistortoides*), spreading phlox , western anemone (*Anemone occidentalis*), louseworts (*Pedicularis* sp.), cinquefoil (Potentilla flabellifolia), rosy spirea (*Spirea rosea*), marsh marigold (*Caltha biflora*), gentians, orange agoseris (*Agoseris glauca*), subalpine daisy (*Erigeron peregrinus*), alpine aster (*Aster alpigenus*), alpine pussytoes (*Antennaria alpina*), sitka valerian (*Valerian sitchensis*), green fescue (*Festuca viridula*), black sedge (*Carex nigracans*), showy sedge (*Carex spectabilis*), wood rushes (*Luzula* sp.), spike trisetum (*Trisetum spicatum*), oat grass (*Danthonia intermedia*), mountain hairgrass (*Deschampsia atropurpurea*).

Above tree line and comprising approximately 19 percent of the park is the alpine zone, generally consisting of snow, ice, rock and fragile alpine plants that are not within the Hazard Tree Management Plan area of potential effect and therefore are not described here.

Table 11: Forest Community Types, Acreage in Park and Potential Acreage Affected

Association, Community Type or Phase	Acres in Park	Potentially Affected Acres in Park *(Watershed noted)*
WET FOREST ECOSYSTEMS		
TSHE/ACTR Association *Tsuga heterophylla/ Achlys triphylla*	677	12.4 or 1.84% Ohanapecosh
TSHE or ABAM/POMU Association *Tsuga heterophylla or Abies amabilis phase / Polystichum munitum*	2,933	29.3 or 0.99% Nisqually
TSHE/OPHO Association *Tsuga heterophylla / Oplopanax horridum*	2,914	10.1 or 0.35% Carbon
ALRU/RUSP Community Type *Alnus rubra / Rubus spectabilis*	Unknown	Not affected
ABAM/OPHO Association (valley and slope phases) *Abies amabilis / Oplopanax horridum*	4,347	8.8 or 0.42% Carbon
ABAM/TIUN Association (climax and seral phases) *Abies amabilis / Tiarella unifoliata*	11,383	9.2 or 0.08% Mowich Nisqually
MODAL FOREST ECOSYSTEMS		
ABAM/VAAL Association (VAAL, BENE, RUPE, CHNO phases) *Abies amabilis / Vaccinium alaskaense or Berberis nervosa or Rubus pedatus or Chamaecyparis nootkatensis*	26,745	114 or 0.42% Nisqually Ohanapecosh White
DRY FOREST ECOSYSTEMS		
TSHE/GASH Association *Tsuga heterophylla / Gaultheria shallon*	3,030	80.3 or 2.65% Nisqually Ohanapecosh
PSME/CEVE Community Type *Pseudotsuga menziesii / Ceanothus velutinus*	Unknown	Not affected
PSME/XETE Community Type *Pseudotsuga menziesii/Xerophyllum tenax*	Unknown	Not affected
PSME/VISE Community Type *Pseudotsuga menziesii / Viola sempervirens*	Unknown	Not affected
PSME/ARUV Community Type *Pseudotsuga menziesii / Arctostaphylos uva-ursi*	343	Unknown Nisqually
ABAM/GASH Association *Abies amabilis / Gaultheria shallon*	2,994	Not affected
ABAM/BENE Association *Abies amabilis / Berberis nervosa*	14,030	Not affected
ABAM/XETE or TSME Association	18,885	2.4 or 0.01% Mowich

(depending on phase) *Abies amabilis or Tsuga mertensiana /* *Xerophyllum tenax*		
ABAM/RULA or ERMO Association *Abies amabilis or Tsuga mertensiana /* *Rubus lasiococcus* (dry east side) *or Erythronium montanum* (wet west side)	10,018	2.4 or 0.01% Nisqually
ABLA2/VASI Community Type Abies lasiocarpa/Valeriana sitchensis	7,655	Not affected
ABAM/RHAL Association *Abies amabilis /* *Rhododendron albiflorum*	13,297	0.3 or 0.01% Mowich
CHNO/VAOV Association *Chamaecyparis nootkatensis /* *Vaccinium ovalifolium*	471	Not affected
ABAM/MEFE and TSME Association (climax or seral phases) *Abies amabilis /* *Menziesia ferruginea*	4,199	1.5 or 0.04% Mowich

Wildlife

Sixty species of mammals are known from Mount Rainier National Park. Another four (Canada lynx, California wolverine, Pacific fisher, and gray wolf) occurred historically, but have not been documented recently. Grizzlies although noted as using surrounding areas, and detected in the mid-1990s near the west boundary of the park, have never been documented in the park. Small mammals include the deer mouse, dusky shrew, Townsend's chipmunk, Douglas squirrel, flying squirrel, hoary marmot, pika and snowshoe hare. Small and medium-sized carnivores include the long-tailed weasel, pine marten, and raccoon, striped and spotted skunks, river otter, bobcat, red fox and coyote. Large mammals include the black bear, black-tailed deer, elk, mountain goat and mountain lion. Canada lynx, wolverine and Pacific fishers are believed to be extirpated from the park and have not been detected in recent targeted surveys (see additional information in Threatened and Endangered Species section). In addition, a number of bats occur in the park, including a nursing colony of the long-eared myotis and the state and federally sensitive Townsend's big-eared bat.

There are over 229 species of birds listed for the park, with approximately 80 of these known to nest in the park (see NPS 1995a: Checklist of the Birds of Mount Rainier National Park). Raptors include the northern goshawk, Cooper's hawk, red-tailed hawk, sharp-shinned hawk, peregrine falcon, merlin, bald eagle, golden eagle, northern saw whet owl, barred owl, great horned owl, western screech owl, etc. Other bird species include the gray jay, varied thrush, red-breasted sapsucker, common flicker, pileated woodpecker, Steller's jay, Oregon junco, hermit thrush, gray-crowned rosy finch, white-tailed ptarmigan, etc.

Approximately 21 species of reptiles and amphibians occur in the park. Some amphibians include the western redback salamander, Pacific giant salamander, northwestern and long-toed salamanders, Van Dykes salamander, tailed frog, Pacific chorus frog, red-legged frog, Cascades frog and western toad. Reptiles include the northwestern garter snake, western terrestrial garter snake, northern alligator lizard, rubber boa, and other species.

Eighteen native species of fish occur in the park, including rainbow trout/steelhead, coho and chinook salmon, sculpin, bull trout and coastal cutthroat trout. In addition there are a number of introduced fish, including brook trout (*Salvelinus fontinalis*).

There are also a wide variety of known and unknown invertebrates, including insects (flies, bees, beetles, etc.), spiders, worms, and freshwater mollusks, including several sensitive species (see below).

Mount Rainier National Park is home to a wide variety of animal species. There are four distinct life zones in which animals occur, although some animals may inhabit several of the life zones depending on the time of year or species.

Below 3,500 Feet: The lowest areas of the park (below 3,500 ft) are characterized by having mature forests of Douglas-fir, western red cedar, grand fir and western hemlock. This zone provides suitable habitat for the northern spotted owl (*Strix occidentalis caurina*), and marbled murrelets (*Brachyramphus marmoratus*) (see specific information below under *Threatened and Endangered Species*). Other birds found in this life zone are barred owls (*Strix varia*), Cooper's hawk (*Accipiter cooperii*), varied thrush (*Ixoreus naevius*), brown creeper (*Certhia americana*), red-breasted sapsucker (*Sphyrapicus varius*), common flicker (*Colaptes auratus*), Steller's jay (*Cyanocitta stelleri*), red-breasted nuthatch (*Sitta canadensis*), Townsend's warbler (*Dendroica townsendi*), chestnut-backed chickadee (*Parus rufescens*), and winter wren (*Troglodytes troglodytes*). Many other birds occur in this zone, which are seasonal visitors or year around residents.

The mammals found in this zone include Trowbridge shrew (*Sorex trowbridgii*), vagrant shrew (*Sorex vagrans*), dusky shrew (*Sorex obscurus*), the mountain beaver (*Aplodontia rufa*), Townsend's chipmunk (*Eutamias townsendii*), Douglas squirrel (*Tamiasciurus douglasii*), flying squirrel (*Glaucomys sabrinus*), deer mouse (*Peromyscus maniculatus*), long-tailed meadow mouse (*Microtus longicaudus*), and Townsend vole (*Microtus townsendii*). The beaver (*Castor canadensis*) is found in low numbers along many of the streams and rivers in this zone. The raccoon (*Procyon lotor*), and spotted skunk (*Spilogale putorius*) are two carnivores which are only found in this zone. Other carnivores found in this zone include the pine marten (*Martes americana*), bobcat (*Lynx rufus*), red fox (*Vulpes fulva*), black bear (*Ursus americanus*), coyote (*Canis latrans*), and mountain lion (*Felis concolor*). Black-tailed deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) can be found in this zone with the highest numbers found during the winter and early spring. Elk populations are the highest in the northeastern and southeastern area of the park. During the winter, mountain goats (*Oreamnos americanus*) can also be found in this zone. Native fish and amphibians are found in the lakes, ponds, streams and rivers in this zone. The fish found in the streams and lakes include rainbow trout (*Oncorhyncus mykiss*), cutthroat trout (*Oncorhyncus clarki*), brook trout (*Salvelinus fontinalis*), and bull trout (*Salvelinus confluentus*). Coho and steelhead occur in the Carbon and White Rivers, Chinook may also occur in the White River. Amphibians found in this zone include Cascades frog, tailed frog (*Ascaphus truei*), the rough-skinned newt (*Taricha granulosa*), Pacific giant salamander (*Dicamptodon tenebrosus*), larch mountain salamander and Van Dyke's salamander. The northern garter snake (*Thamnophis ordinoides*) and the common garter snake (*Thamnophis sirtalis*) are also found in this life zone. These amphibians and fish also occur in the higher elevation zones up to 6,500 feet.

3,500-5,000 Feet: The next zone of the park (3,500 to 5,000 feet) is characterized by its mixed forests of western white pine, western hemlock, and Pacific silver fir. Blue grouse (*Dendragapus obscurus*) are found in this zone along with sharp-shinned hawk (*Accipiter striatus*), golden-crowned kinglet (*Regulus satrapa*), northern three-toed woodpecker (*Picoides tridactylus*), hermit thrush (*Catharus guttatus*), and yellow warbler (*Dendroica petechia*). Many bird species occur in this zone depending on weather, food sources, migration, and breeding season. Mammals in this zone include masked shrews (*Sorex cinereus*), Townsend's chipmunk, yellow pine chipmunk (*Eutamias amoenus*), golden mantled ground squirrels (*Callospermophilus saturatus*), Douglas squirrels, flying squirrels, deer mice, and the jumping mouse (*Zapus trinotatus*). The large predators found in the lower zone are also found in this zone. The long-tailed weasel (*Mustela frenata*) and pine martin are very common in this zone. Mountain goats may be found in this area

in the winter and spring. Deer and elk are common here, especially in the summer and fall. There are also Cascades and red-legged frogs, and larch mountain and Van Dyke's salamanders.

5,000-6,500 Feet: The elevational zone in the park which attracts most summer visitors is between 5,000 and 6,500 feet (where Paradise and Sunrise are located). This zone is characterized by mixed forest and subalpine meadows. The trees are primarily subalpine fir, mountain hemlock, Alaska yellow cedar, and whitebark pine and they tend to grow in clumps. The birds of this zone include the Clark's nutcracker (*Nucifraga columbiana*), common raven (*Corvus corax*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), western flycatcher (*Empidonax difficilis*), rufous hummingbird (*Selasphorus rufus*), mountain bluebird (*Sialia currucoides*), and Lincoln's sparrow (*Melospiza lincolnii*). Many of these birds can be found in other zones depending on the season. This is the zone where elk congregate in the summer months, especially on the eastern half of the park. In this zone there are pika (*Ochotona princeps*), snowshoe hare (*Lepus americanus*), hoary marmot (*Marmota caligata*), golden-mantled ground squirrel and yellow pine chipmunk. In the meadows are numerous pocket gophers (*Thomomys talpoides*). A common carnivore is the pine marten, with black bear, coyote, red fox, and mountain lion visiting this zone in the summer and fall. There are some large herds of mountain goats in this zone. There are numerous ponds and lakes, some of which have historically been stocked with rainbow, cutthroat, and brook trout. Many of the ponds have populations of amphibians including northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), western toad and Cascades frog (*Rana cascadae*).

Above 6,500 Feet: Over 80 square miles of Mount Rainier National Park is above 6,500 feet. Snowfields, glaciers and bare rock outcrops, characterize this zone that would not be affected by the proposed Hazard Tree Management Plan.

Special Status Species

The following species are federal and/or state listed or proposed as threatened, endangered, sensitive or species of concern.

PLANTS

The following plants are all considered state sensitive and do not have federal status: obscure Indian paintbrush (*Castilleja cryptantha*), Mount Rainier lousewort (*Pedicularis rainierensis*), northern microseris (*Microseris borealis*), Wheeler's bluegrass (*Poa nervosa*), crested wood-fern (*Dryopteris cristata*), curved woodrush (*Luzula arcuata*), skunky Jacob's-ladder (*Polemonium viscosum*), pygmy saxifrage (*Saxifraga rivularis*), tall agoseris (*Agoseris elata*).

Whitebark pine (*Pinus albicaulis*) is a federal species of concern. Whitebark pine occurs at and above forest line, reaching in some cases to treeline within the park. Most whitebark pine populations occur on the north and northeast flanks of Mount Rainier; however, there are a few isolated populations to the south. Whitebark pine varies in structure with upright trees (generally less than 60 feet tall) growing in a low to moderately dense forest with subalpine fir and mountain hemlock at the lower elevations of its range. At higher elevation and near treeline, trees can have krummholz form with skirting, growing individually or in small dense clusters.

Whitebark pine occurs in the vicinity of the Sunrise developed area and in few backcountry camps at higher elevations.

The primary cause of structural defects in whitebark pine trees in the park is the introduced blister rust (*Cronartium ribicola*). Blister rust causes cankers and eventually mortality in most affected trees. While presence of blister rust in a tree would not necessarily render a tree 's structure sufficiently compromised such that it would rate as a high hazard, dead trees within striking distance of a target would be considered hazards. Due to the short stature, and subsequent small area within which a tree could fall, there will be very few individual trees that would be evaluated in the Hazard Tree Management Plan. Mostly it would be dead trees that would rate

high enough to be considered for treatment. Removal of these already dead trees would have no effect on the survival of whitebark pine in Mount Rainier National Park.

WILDLIFE

Table 12: Special Status Wildlife

FT = Federally Threatened
FE = Federally Endangered
FPROP = Federally Proposed
FSC = Federal Species of Concern
FC = Federal Candidate
ST = Washington State Threatened
SE = Washington State Endangered
SS = Washington State Sensitive
SC = Washington State Species of Concern
-- = No Status

WILDLIFE SPECIES	FEDERAL STATUS	STATE STATUS	HABITAT NEEDS OCCURRENCE
^Northern Spotted Owl *Strix occidentalis caurina*	FT	SE	See detailed information below
^Marbled Murrelet *Brachyramphus marmoratus marmoratus*	FT	ST	See detailed information below
Northern Bald Eagle *Haliaeetus leucocephalus*	FSC	ST	See detailed information below
Golden Eagle *Aquila chrysaetos*	--	SC	Golden eagles have been seen throughout the park in suitable habitat. They are believed to nest in the park. (NPS 1995a). There would be no effect on golden eagles.
Merlin *Falco columbarius*	--	SC	Merlins are rare park visitors to subalpine areas in summer and occasionally are noted in fall. No known nesting occurs. (NPS 1995a). There would be no effect on merlins.
^Northern Goshawk *Accipter gentilis*	FSC	SC	Goshawks nest in trees in mature or old growth coniferous forests. Visitors and biologists regularly observe goshawks in the park. There would be no effect on northern goshawks.
^Peregrine Falcon *Falco peregrinus*	FSC	SS	Peregrines have been taken off the Endangered Species List, but remain a federal species of concern. Peregrines nest primarily on cliffs along rivers or near lakes. In the spring and fall, migrants may pass through the park. Peregrines nest near the southwest corner of the park. There would be no effect on peregrine falcons.
Ferruginous Hawk *Buteo regalis*	--	ST	Ferruginous hawks nest in cliffs or trees and frequent arid plains and open rangeland. Migrants may pass through the park. There would be no effect on ferruginous hawks.
Pileated Woodpecker *Dryocopus pileatus*	--	SC	Pileated woodpeckers are relatively common in low elevation forest. There would be no effect on pileated woodpeckers.
^Oregon Vesper Sparrow *Pooectetes gramineus affinis*	FSC	--	It is not known whether this newly described subspecies occurs in the park. Oregon vesper sparrow life history suggests that only drier, open areas on the east side of the park

			would be suitable habitat. There would be no effect on vesper sparrows.
^Olive-sided Flycatcher *Contopus cooperi*	FSC	--	This flycatcher breeds in the park and prefers forest edges adjacent to open areas, such as burns, montane meadows, and subalpine areas. There would be no effect on olive-sided flycatchers.
Vaux's Swift *Chaetura vauxi*	--	SC	Vaux's swifts may be found in forested areas and are considered common in spring, summer and fall. They are believed to nest in the park. (NPS 1995a) There would be no effect on Vaux's swifts.
^Gray Wolf *Canis lupus*	FE	SE	See detailed information below
^Canada Lynx *Lynx canadensis*	FT	ST	See detailed information below
^Grizzly Bear *Ursus arctos*	FT	SE	See detailed information below
^California wolverine *Gulo gulo luteus*	FSC	SC	Wolverines inhabit high elevation coniferous forests and subalpine areas and have home ranges of up to 100 square miles. Wolverines were last documented in the park in 1933. There would be no effect on wolverines.
^Pacific Fisher *Martes pennanti pacifica*	FC	SE	Pacific fishers inhabit dense forests, with extensive continuous canopies and complex forest floor structures and are often associated with wetland or riparian areas. Fishers have declined throughout their range and may be on the verge of extinction in Washington State. Fishers were last documented in the park in 1947, with more recent unconfirmed observations in the 1990s. A state reintroduction program is in planning development but immediate release sites are not likely to include the park. A 1991 study in the southeastern park did not detect them (Jones and Raphael 1992), nor did recent hair snare and remote camera bait station surveys (1999-2001). There would be no effect on Pacific fishers.
^Long-eared Myotis *Myotis evotis*	FSC	--	Long-eared myotis' inhabit forests and chaparral. A nursing colony occurs near Longmire. There would be no effect on long-eared myotis.
^Long-legged Myotis *Myotis volans*	FSC	--	Long-legged myotis' forage over ponds, streams, open meadows and forest edges. Night roosts occur in caves or mines. This species occurs in the park. There would be no effect on long-legged myotis.
^Pacific Townsend's Big-Eared Bat *Plecotus townsendii townsendii*	FSC	SC	Big-eared bats hibernate in caves and use caves and abandoned buildings for breeding and roosting.

			Nursery colonies are extremely sensitive to human activity. Two hibernacula occur near Longmire. There would be no effect on big-eared bats.
Chinook Salmon *Oncorhynchus tshawytscha* (Puget Sound ESU)	FT	SC	See detailed information below
^Bull Trout *Salvelinus confluentus*	FT	SC	See detailed information below
Bull Trout Critical Habitat *Salvelinus confluentus*	Designated	--	See detailed information below
Dolly Varden *Salvelinus malma*	FPROP	SC	Dolly Varden are proposed under the similarity of appearance provision of the Endangered Species Act. They occupy the same habitats and are nearly indistinguishable from bull trout.
Coho Salmon *Oncorhynchus kisuytch*	FPROP	--	Coho were historically found in the White, Carbon, Mowich and North and South Puyallup rivers. It is likely that they are present in small numbers in these rivers; however no surveys have confirmed this. There would be no effect on coho salmon.
^Coastal Cutthroat Trout *Oncorhynchus clarki clarki*	FSC (Western Cascades) FT (Eastern Cascades)	--	The eastern Cascades portion of the coastal cutthroat is listed as threatened. Coastal cutthroats on the west were determined not warranted for listing. Although coastal cutthroat occur in the park, they are considered introduced. There would be no effect on coastal cutthroat trout.
Steelhead *Oncorhynchus mykiss*	FT (Puget Sound)	SC	An anadromous form of rainbow trout, steelhead may be present in the Carbon and White Rivers. There would be no effect on steelhead.
^Cascades Frog *Rana cascadae*	FSC	--	Cascades frogs occur in mountainous areas, marshes and ponds. Distribution within the park is not well known. They have been documented throughout the park. There would be no effect on Cascades frogs.
^Tailed Frog *Ascaphus truei*	FSC	--	Tailed frogs are relatively common in the park and have been found in all suitable habitat when surveyed. There would be no effect on tailed frogs.
^Western Toad *Bufo boreas*	FSC	SC	According to historic data, western toads were formerly more abundant in the park. They have recently been found in only a few montane lakes and wetlands.
^Columbia Torrent Salamander *Rhyacotriton kezeri*	FSC	SC	This species occurs adjacent to the park and is expected to occur in the park. There would be no effect on Columbia torrent salamanders.
^Larch Mountain Salamander *Plethodon larselli*	FSC	SS	Larch mountain salamanders are found in forested and talus

			environments in cool, moist conditions under wood or rock. They have been found in several locations in the park. There would be no effect on Larch Mountain salamanders.
^Van Dyke's Salamander *Plethodon vandykei*	FSC	SC	This species is found in a variety of habitats, including streambanks, upland forests, talus areas and seeps at a range of elevations. They have been documented in several park areas. There would be no effect on Van Dyke's salamanders.
California Floater Mussel *Anodonta californiensis*	FSC	SC	Freshwater mollusks inhabit permanent waters of all sizes. This one is expected to occur, but surveys have not confirmed it. The proposed action would not affect floater mussels or their habitat.
^Fender's Soliperlan Stonefly *Soliperlan fenderi*	FSC	--	This species has been documented several times near the Westside Road and is expected to be present elsewhere in the park. The proposed action would not affect soliperlan stoneflies or their habitat.
Mardon skipper *Polites mardon*	FC	SE	Not documented from the park. There would be no effect on this species.

^ species identified in most recent USFWS consultation (6-27-03) as potentially utilizing habitat within the park

Gray Wolf

Gray wolves are wide ranging carnivores that inhabit forests and tundra. Historically, the wolf was present in the state of Washington but thought to have been eliminated as a breeding resident by 1930 (Young 1944, USDI 1987). Gray wolves were historically found in the park. Numerous observations were recorded from the late 1800s – 1920s (Taylor and Shaw 1927). Recent wolf observation reports in the park (in the last 20 years) have not been confirmed by biologists. The Washington Department of Fish and Wildlife (WDFW), however, maintains a database of a small number of these in the park area that they consider to be reliable observations. Semi-domesticated hybrid wolf-dogs were documented by the WDFW and NPS in the eastern portions of the park during the 1990s. Hybrids may be the source of the recent reports. Multifaceted carnivore surveys were conducted at MORA from 2000-2002 to include the National Lynx Detection Protocol, snow tracking, and baited camera stations (Mount Rainier National Park unpublished data). No wolf evidence was documented. Since there is no documented evidence that wild wolves occur within Mount Rainier National Park, the hazard tree management program would have *No Effect* on this species.

Grizzly Bear

Grizzly bears are omnivores that inhabit semi-open country, usually in mountain areas. They require large home ranges from 30 to 100 square miles in size (Van Gelder 1982). Historically, the grizzly was present in the state of Washington but thought to have been eliminated as a breeding resident by 1930 (Young 1944). The park contains some suitable grizzly bear habitat, but there have never been confirmed sightings of grizzlies in the park. In 1993, grizzly bear tracks were identified by WDFW a few miles west of the park's west boundary. No observations have been recorded in that vicinity or anywhere near the park since 1993. Since there is no evidence that grizzly bears occur within Mount Rainier National Park, the hazard tree management program would have *No Effect* on this species.

Canada Lynx
In the Cascade Mountains, lynx live in the spruce-fir forests of the high mountains. Older, mature forests with downed trees and windfalls provide cover for denning sites, escape, and protection from severe weather. The distribution and abundance of lynx tend to be tied to that of its primary prey, the snowshoe hare. Canada lynx have probably never been abundant in most of the lower 48 states because of a lack of lynx and snowshoe hare habitat. Their numbers declined due to over-trapping in the 1980s and from a loss of forest habitat caused by development and urbanization, forest fire suppression, and unsuitable forest management. Bobcats and coyotes also have spread into lynx habitat. Biologists suspect that packed snow trails created by recreational activities could allow bobcats and coyotes to compete with lynx for food and space.

Historically, the lynx was present in the state of Washington but thought to have been eliminated as a breeding resident by 1930 (Young 1944). The last lynx documented at Mount Rainier was in 1934. Recently, multifaceted carnivore surveys were conducted at Mount Rainier from 2000-2002 to include the National Lynx Detection Protocol, snow tracking, and baited camera stations. No lynx detections have been generated from these efforts or from any other means since 1934 (NPS, Mount Rainier National Park unpublished data). Since there is no documented evidence that lynx currently occur within Mount Rainier National Park, the hazard tree management program would have *No Effect* on this species.

Northern Bald Eagle
Detailed accounts of ecology, range and taxonomy of the bald eagle may be found in the Pacific Bald Eagle Recovery Plan (USFWS 1986), Bald Eagle Management Guidelines for Oregon-Washington (USFWS 1981), and various other references (Stinson *et al.* 2001, Watson and Pierce 1998). Bald eagles were federally listed as threatened within the lower 48 states in 1967. On June 28, 2007, the USFWS delisted the bald eagle.

Suitable Habitat: Nesting habitat is characterized by large, live-topped trees or large snags normally in close proximity to major bodies of water such as lakes, rivers or the ocean. In Washington, 99 percent of nests are within one mile of a lake, river or marine shoreline. The nest tree is usually situated to provide an unobstructed view of the water. Bald eagles typically roost communally at night in multi-canopied forest stands with large diameter trees and are located in areas that moderate the effects of prevailing winds and seasonal storms. Bald eagles commonly build alternate nests in their nesting territory and exhibit strong fidelity to nest territories.

Breeding and Wintering Seasons: For the purposes of this analysis, bald eagle breeding season is between January 1 and August 15; bald eagle wintering season is between October 31 and March 15.

Due to the lack of suitable large river/large lake habitat, bald eagles may use Mount Rainier National Park seasonally, but there is no evidence of breeding activity in the park. A wintering population is found along the Cowlitz River several miles south of Mount Rainier National Park (T. Kogut pers. comm. 2003) and a single nest exists near the town of Elbe approximately 20 miles west of the southwest park boundary.

Effects: Since there is no evidence that eagles reside or breed within Mount Rainier National Park, the hazard tree management program would have *No Effect* on this species.

Bull Trout
Bull trout (*Salvelinus confluentus*) historically were found in most major river systems in the Pacific Northwest and western Canada. Bull trout have been defined as a distinct species (Cavender 1978). Biologists had previously identified bull trout as Dolly Varden (*Salvelinus malma*), largely because of the external similarity of appearance. Both species occur together in western Washington.

Bull trout are a threatened species because of a host of factors. Habitat degradation and fragmentation from land management activities such as timber harvest, mining, road construction and maintenance, hydro power and water diversion are a primary factor. Over fishing and competition with introduced non-native fishes, such as brook trout *Salvelinus fontinalis*, are also contributing factors in their decline (Bond 1992; Donald and Alger 1993). Genetic studies have not been conducted on native charr in MORA to differentiate between bull trout and Dolly Varden. Therefore "native charr" is used to discuss bull trout presence in the park. However, one specimen found in the Carbon River watershed in 1993 was positively identified as bull trout by Doug Markel, Oregon State University.

Suitable Habitat: In Mount Rainier, native charr occur in the cold water streams of the Puyallup River basin which include several park watersheds including Carbon, Upper White River, West Fork (White), Mowich, and Upper Puyallup (north and south forks). No native charr have been documented in the Nisqually, Cowlitz/Ohanapecosh River or Huckleberry Creek watersheds in the park.

Bull trout have relatively specific habitat requirements compared to other salmonids (Rieman and Mclntyre 1993). Habitat components that appear to influence distribution and abundance include water temperature, cover, channel form/stability, valley form, spawning and rearing substrates, and availability of migratory corridors (Rieman and Mclntyre 1993). Bull trout primarily inhabit colder streams, although individual fish are often found in larger river systems (Fraley and Shepard 1989, Rieman and McIntyre 1993, 1995). Water temperature above 15 degrees C (59 degrees F), however, is believed to limit bull trout distribution, thereby partially explaining their patchy distribution within a given watershed (Fraley and Shepard 1989; Rieman and Mclntyre 1995). Bull trout habitat is characterized by clear cold water, silt-free rocky substrate in riffle run areas, well-vegetated streambanks, abundant in stream cover, deep pools, relatively stable flow regime and streambanks, and productive fish and aquatic insect populations. Bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993)

Bull trout exhibit resident and migratory life history strategies throughout much of their current range (Rieman and McIntyre 1993). Resident bull trout presently exist as isolated remnant populations in the headwaters of rivers that once supported larger, more fecund migratory forms. These remnant populations have a low likelihood of persistence (Reiman and McIntyre 1993). Bull trout are opportunistic feeders, with resident and juvenile migratory bull trout preying upon terrestrial and aquatic insects and small fish (Goetz 1989; Donald and Alger 1993). Adult bull trout are primarily piscivorus, feeding on various salmonids, yellow perch and sculpin species (Fraley and Shepard 1989; Donald and Alger 1993).

Breeding Season: Individuals normally reach sexual maturity in four to seven years, and can live as long as 12 years. Bull trout are iteroparous, spawning more than once in a lifetime. The size and age of maturity for bull trout is variable depending upon life-history strategy. Resident fish tend to have slower growth rates, reach maturity at a smaller size, and have lower rates of fecundity than the migratory form (Fraley and Shepard 1989; Goetz 1989). Adults range from 150 to 300 millimeters long for residents, and up to 600 millimeters for migratory fish (Pratt 1984; Goetz 1989).

Bull trout spawn in the fall after temperatures fall below about 8 degrees C. The spawning season varies but is considered to be from the beginning of September to the middle of October. In Mount Rainier National Park, bull trout typically spawn from late August to November during periods of decreasing water temperatures (NPS 2001). Bull trout have been documented to travel as far as 250 kilometers to reach spawning grounds (Fraley and Shepard 1989).

Effects: Removal of hazard trees will be done in such a manner that the tree would be felled where it would naturally fall without human intervention. Therefore, if the tree would fall into or near a stream, it would be felled in this direction. This would, however, occur only in a few areas (Ipsut Creek Campground, White River Campground), since most developed areas are located

away from streams. Since there is no evidence that felling trees would change the habitat for bull trout within Mount Rainier National Park, the hazard tree management program would have *No Effect* on this species.

Chinook Salmon
Chinook salmon (*Oncorhynchus tshawytscha)* distribution historically ranged from the Ventura River in California to Point Hope, Alaska in North America, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). The Puget Sound chinook salmon Ecological Significant Unit (ESU) was listed as threatened on May 24, 1999 (NMFS 1999). This ESU includes all naturally spawned populations of chinook salmon from rivers and streams flowing into Puget Sound. The Lower Columbia River ESU was listed as a threatened species on March 24, 1999. That ESU includes all naturally spawned populations of chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, including the Cowlitz River Drainage in Mount Rainier National Park.

Breeding Season: Runs of spring chinook begin their upstream migration in the Puyallup/ White river in late May. The spring chook run is defined as those fish that arrive at Buckley trap on or before August 15 annually (USDA, 1995). They are released above the dam flood control and have peak spawning in the White River headwaters between August-September. The fall chinook run arrives after August 15 and spawn September to mid November. Spawning primarily occurs in October and the precise location of natural spawning is not well known. A small population of native spawners still returns to the White River (USDA, 1995). Chinook outmigrate one year later in April/May coinciding with the natural spring run-off pattern of Mount Rainier. One observation of Chinook was made by park staff in May 2002, in the White River, near the park boundary.

Effects: Similar to effects on bull trout, removal of hazard trees would be done in such a manner that the tree would be felled where it would naturally fall without human intervention. Therefore, if the tree would fall into or near a stream naturally, it would be felled in this direction. This situation is most likely to occur along the Carbon River and White River (Ipsut Creek Campground, White River Campground. Since there is no evidence that felling trees would change the habitat for Puget Sound Chinook within Mount Rainier National Park, the hazard tree management program would have *No Effect* on this species.

Northern Spotted Owl
The northern spotted owl is an uncommon year-round resident of the park (breeding between March and September). The owl is a medium sized nocturnal owl that preys primarily on small mammals. It is strongly associated with mature or old growth forests that are structurally complex – containing trees of several species, sizes, and ages, standing and down dead trees, with multistoried canopies. Moreover, the birds require large amounts of such habitat. Median home range sizes are typically on the order of 3,000 to 5,000 acres per pair. Spotted owls nest in cavities or platforms in trees, and in good habitat, pairs are typically spaced about 1–2 miles apart. Spotted owls are long-lived, territorial birds, often spending their entire adult life in the same territory. Nest trees may include Douglas-fir, grand fir, Pacific silver fir and other species and are usually found in forests up to 4,800 feet in elevation.

Habitat degradation and loss threaten this species with extinction. Much of the remaining habitat is highly fragmented. In addition, barred owls *(Strix varia)* have invaded much of the range of the northern spotted owl during the last 30 years and have displaced and hybridized with spotted owls (Dunbar *et al.* 1991; Thomas *et al.* 1993; Hamer *et al.* 1994). Since listing, Anderson and Burnham (1992) indicate northern spotted owl populations continue to decline throughout their range and this decline may be accelerating. Large scale analysis of the northern spotted owl over 23percent of its range, including Mount Rainier National Park, indicated that populations

were either relatively stable or were experiencing a decline (3.9percent annually for female owls) (Franklin *et al.* 1999).

Critical Habitat: No critical habitat has been designated within Mount Rainier National Park, although approximately 82,000 acres of the park contain high quality northern spotted owl habitat. Critical habitat was not designated because the park habitat is protected from adverse effects by virtue of its national park status. The draft recovery plan listed a number of threats to the population including low and declining populations, limited and declining habitat, poor habitat distribution, and predation.

Many known locations for spotted owls are within one to two miles of the park boundary. They have been reported in forests along Westside Road, near the Longmire complex, near Ohanapecosh, near the Sunrise complex, along the State Route 410 corridor, and along Carbon River Road. Numerous nest activity sites have been located in the park.

Prior to 1997, the extent of northern spotted owl surveys at Mount Rainier was limited, with less than 25 percent of potentially suitable owl habitat examined. Only those surveys conducted after 1994 were done according to accepted protocols most recently outlined by Franklin *et al.* (1996) and Forsman (1995). The most comprehensive inventory, when much of the park's suitable habitat was surveyed, was performed in 1997 and 1998. This inventory substantially improved the understanding of the distribution and reproductive status of the northern spotted owl in the park. Northern spotted owls are found up to 4,500 feet in elevation in the park (although the 82,000 acre measurement includes areas up to 4,800 feet that are potential habitat to potentially escape barred owl invasions). Twenty-seven demographic monitoring activity areas have been documented since monitoring began (Myers and Schaberl 2003). Park northern spotted owl habitat comprises approximately 40 percent of the Rainier Demographic Study Area, one of the 14 areas monitored in the range of the northern spotted owl. The latest meta-analysis by Anthony *et al*. (2004) models a nearly 11 percent annual decline for the Rainier Demographic Study Area population.

As a result of the inventory of suitable northern spotted owl habitat, 27 northern spotted owl activity sites were identified in the park. These sites are monitored annually. All of the developed areas and backcountry camps have been surveyed for northern spotted owls. Only about 10 percent of the suitable northern spotted owl habitat remains unsurveyed and all of this area is well away from any developed areas, roads, trails and backcountry campsites.

Suitable Habitat: Suitable habitat for the northern spotted owl is characterized by forested stands capable of providing nesting, roosting, and foraging habitat. Suitable habitat is defined as old growth or late-successional coniferous forests with moderate to high canopy closure (greater than 60 percent); multi-canopied, multi-species, with some trees greater than 30 inches in diameter-at-breast-height (DBH) with cavities, platforms, or mistletoe brooms capable of providing a nest site. These stands also typically have high levels of snags and coarse woody debris capable of providing prey base habitat for northern flying squirrels, bushy-tailed woodrats, red-backed voles and other small ground mammals.

Northern spotted owl dispersal habitat is defined as those forested stands with an average stand diameter equal to or greater than 11 inches in diameter and having a stand canopy closure equal to or greater than 40 percent. Forested stands in this condition permit young owls to disperse from the natal area and allow adult spotted owls to access other stands of suitable habitat without having to cross open ground. Of the approximately 82,000 acres of suitable habitat an unknown (but relatively small) amount of dispersal habitat is present.

Breeding Season: For impact analysis purposes, the breeding season for spotted owls is divided into an early season of March 15 to July 31, and a late season of August 1 to September 30. Adult spotted owls begin territory establishment during the month of February and egg laying may begin as early as the third week of March and continue into April. One to three eggs may be laid.

Incubation may begin as early as late March and through the second week in April. Incubation takes approximately 30 days. Young are fed by both parents. Most fledglings leave the nest during late June approximately 64 to 66 days after eggs are laid. Fledglings throughout the range of the owl normally remain within the nest stand through the month of September and begin dispersal in October.

Risk Analysis: Implementation of the park's hazard tree management plan has the potential to remove a very small amount of suitable spotted owl habitat each year. There is the potential for noise disturbance, particularly in the early season. The effects of noise disturbance on fledged juveniles are much less than during the nesting stage.

Marbled Murrelet

The marbled murrelet is a small seabird that feeds on fish in ocean waters within one mile of the shore. Due to their secretive nature and cryptic coloration, information on the distribution and abundance of marbled murrelets in Washington has been difficult to gather (NPS 1996a). Marbled murrelets nest in forested areas up to more than 55 miles from their saltwater foraging areas. Nest trees need to be in a stand that is open enough for them to fly through, yet the canopy must have enough cover to hide the nests from predators. Typically such conditions have only been found in old growth or later seral stands; however some younger stands with a high degree of structural diversity and limb-malforming infestations (i.e. mistletoe) may also be suitable.

The marbled murrelets' threatened status is thought to be principally due to a loss of nesting habitat due to commercial timber harvesting. Forest fragmentation also may be making nests near forest edges vulnerable to predation by other birds, such as jays, crows, ravens, and great horned owls. In addition, increased human activities in forests, such as picnic grounds, can attract corvids and thus increase the chances of predation (USFWS 1991, 1992).

Critical Habitat: No critical habitat has been formally designated for marbled murrelets within Mount Rainier National Park. Like the northern spotted owl, critical habitat was not designated because the park habitat is protected from adverse effects by virtue of its national park status. The murrelet population within Washington, Oregon, and California is thought to be declining at a rate of at least four percent per year (USFWS 1997). Suitable nesting habitat in Washington, Oregon, and California is found in old growth coniferous stands that are multi-layered with moderate to high canopy closure (Hamer and Nelson 1995, Nelson 1997). Forested stands with old growth remnants are also used. Trees with suitable nest platforms are typically greater than 200 years of age and at least 20 inches in diameter at breast height although trees in productive ground may develop these characteristics at a earlier age (or faster rate) (Ralph *et al*. 1995). Younger trees may also develop platforms through mistletoe infestation or in reaction to damage from wind or ice.

Murrelets are known to occur in two major watersheds across five river valleys in the park in areas below about 3,800 feet in elevation. Approximately 25,300 acres of forested area below 3,800 feet is defined as current habitat (Myers 2003). Inland surveys have been conducted since 1996 according to Pacific Seabird Group protocols in areas of all major park watersheds in both frontcountry and of backcountry settings. Murrelet presence is documented within four river area corridors – the Carbon, Mowich, Puyallup and Nisqually rivers. Occupied behavior detections have been documented at only three of the four locations (Anderson and Nelson 1998, Myers 2003). Relatively contiguous *occupied* habitat has been mapped for the within-park watersheds of the Carbon, Mowich, and Puyallup rivers an estimated 8,780 acres of occupied habitat below 3,800 feet. Three RADAR surveys (2000, 2005, 2008) completed near the Nisqually Entrance and Kautz Creek documented a small number of target detections along the Nisqually River, however no occupied behavior has been documented in the Nisqually watershed (Hamer Environmental 2000, ABR 2005, ABR 2008). Despite many years of surveys at several locations, no ground observer has ever detected murrelets in that watershed (Myers 2003). No active nests have been located within the park. Although watersheds in the eastern portions of the park are

potential habitat, murrelets have never been documented in the area and these areas are not included in the 25,300 acre current estimate of suitable habitat. These potential habitat watersheds, especially the Ohanapecosh/Muddy Fork/Stevens Creek portions of the Cowlitz watershed are located more than 80 miles from ocean habitat and are presumed to be too far away from saltwater to be useful to murrelets.

Breeding Season: For the purposes of this analysis, the breeding season for murrelets is divided into an early season of April 1 to August 5, and a late season from August 6 through September 15 at Mount Rainier National Park.

In Washington, on average, incubation begins in April and extends through July. Both sexes incubate the egg for about 30 days, and average nestling period extends from late May through August, lasting about 30 days. The total length of breeding season averaged 124 days (Hamer and Nelson 1995). Adults feed the chicks up to eight times a day, most often at dusk and dawn. Adults leave the chicks alone on the nest except when actively feeding. A fledgling's first flight is presumed to be from the nest directly to the marine environment.

Risk Analysis: The marbled murrelet is thought to be most vulnerable to noise disturbance during the early breeding season when adults are producing and incubating the eggs. Startling the adult from the nest while it is incubating the egg or chick could result in the loss of the egg or chick. Once the chick is left alone for most of the day, the risk of noise disturbance causing the loss of the murrelet is reduced. Throughout the entire breeding season, adult murrelet activity near the nest site is highest within 2 hours before and after sunrise and sunset. Adult flights into/out of the nest, however, have been documented at all hours of the day.

Surveys conducted by the NPS and U.S. Forest Service on the Olympic Peninsula using the Pacific Seabird Group protocol indicate murrelet detections generally peak in July and taper off at the beginning of August. Similar results have been found at Mount Rainier National Park (Myers 2003). Updated nest information for California and Oregon indicates that up to 20 percent of nests are active in August, while 8 to 10 percent are still active in September (Nelson pers. comm. 2001). Nelson estimates that approximately 90 percent of nests have fledged by August 20. Half of murrelet chicks in Washington for which a fledging date is known fledged by August 5, with a mean fledge date of August 2 (W. Ritchie, WDFW, personal comm. 2/9/04). Obviously, the later potentially disturbing activities are carried out, the less likelihood there is for actions to affect reproduction.

Actions described in the park hazard tree management plan would result in a small loss of suitable murrelet nesting habitat. There is also a risk from noise disturbance and impacts associated with chainsaw and heavy equipment use.

Archeology

Only a small percentage of the park has been surveyed for archeological resources. As of the 2002 field season, the park had documented 40 prehistoric and multi-component (prehistoric and historic) sites, 29 prehistoric isolated finds, and 31 historic sites and isolated finds. Most documented archeological sites (74 percent) are found within subalpine communities, with approximately 16 percent in alpine habitats. The rest (10 percent) have been found in forested habitats, where more continuous vegetative cover and deposition, makes it difficult to detect archeological remains. Of the sites located, 75 percent are found on slopes of 5 degrees or less and 75 percent are within 300 feet of water. Archeological modeling predicts the greatest intensity of prehistoric use in subalpine communities and in the upper forest margins that would have supported similar communities as recently as the last "Little Ice Age" approximately 500-150 years ago.

The oldest confirmed dated deposits come from an estimated 3,500 years before the present. Other preserved stratigraphically dated profiles, indicate buried soil to 8,500 years ago. It is likely that the archeological record in the park will be extended to that period. Very early sites are

difficult to locate, owing to burial 3-5 feet below the surface and the effects of ash and mudflow deposits.

The most intensive survey efforts have been associated with rehabilitation and construction related projects in the developed areas of the park (including trails and backcountry camps) during the last ten years. Less intensive reconnaissance efforts have focused on subalpine and alpine landscapes, and several forest settings. Other survey efforts have concentrated in areas where known archeological resources have been reported. Understanding of the park's prehistoric use patterns is based on the results of these surveys, on the archeological record in the vicinity of the park, and on environmentally-based models of human subsistence and settlement patterns in mountainous environments (Burtchard 1998). Knowledge of the historical archeological record also relies on these sources, plus written records, informant accounts and historic documents.

Prehistoric archeological evidence is dominated by low to moderate-density lithic scatters, most of which are exposed on the soil surface. Dominant materials are cryptocrystalline silicate rock, most of which originated outside the park. Because of the volcano's depositional history, a relatively small fraction of the total remainder of artifacts anticipated is found on the surface. As a result, most of the material is found under the surface.

Ethnography / Traditional Use

Ethnographic resources are defined as landscapes, sites, structures, objects or natural resource features that have significance based on importance attached to them by members of socio-cultural groups. At Mount Rainier, these resources are most closely associated with at least six contemporary Native American tribes – Nisqually Indian Tribe, Muckleshoot Indian Tribe, Puyallup Tribe of Indians, Confederated Tribes and Bands of the Yakama Nation, Cowlitz Indian Tribe, and Squaxin Island Tribe.

Mount Rainier has long been an important place and a symbolic landmark for Native Americans. In addition to hunting, archeological evidence suggests that prehistoric people used high elevation and forested landscapes on Mount Rainier to gather a variety of economic, medicinal and ceremonially important resources for thousands of years (Burtchard 1998). Investigations into the archeology, history and ethnography of Mount Rainier National Park (Smith 1964, Thompson 1981, Catton 1996, Carr 1997, Boxberger 1998, Burtchard 1998, and Onat 1999) indicate that these practices continued into the twentieth century as well. Among other products, gathering bear grass and cedar splits for basketry and collecting plants for medicinal, ceremonial and religious uses has been documented through 1950 (Boxberger 1998). Similar uses continue to the present. While few specific ethnographic resources, other than archeological sites, have been documented to date, it is important to recognize that Mount Rainier remains important as a place for spiritual and traditional use for Indian people today.

Native American use of the park has continued into the present day, with some tribes possessing or negotiating agreements for the collection of specified quantities of native plants to continue cultural traditions. It is possible, perhaps probable, that significant but undocumented archeological and ethnographic resources, (including ceremonial locations) exist throughout the park in areas used by the current Native American Tribes and prehistoric use by ancestors of these peoples. Other, less known use for ceremonial or spiritual purposes also occurs but has not been well-documented.

Historic Structures

There are approximately 158 historic resources in the park individually and collectively listed on the National Register of Historic Places. Many more sites, structures and objects are potentially eligible for the National Register. Prior to designation of the Mount Rainier National Historic Landmark District, six historic districts were designated in the park for their rustic architectural significance. These include:

- Nisqually Entrance Historic District
- Longmire Historic District
- Paradise Historic District
- Camp Muir Historic District
- White River Entrance Historic District
- Sunrise Developed Area Historic District

Each of these historic districts exhibits significant examples of NPS rustic architecture in the style of the period of its development. In addition, there are 5 National Historic Landmark buildings or building complexes that have been designated in the park. These represent the some of the best designs of the period and, in many cases, were used as models in other National Parks for similar structures. They include:

- Longmire Community Building,
- Longmire Administration Building,
- Longmire Service Station,
- Paradise Inn, and the
- Sunrise Blockhouses/Stockade Complex.

Cultural Landscapes

The Mount Rainier National Historic Landmark District was designated in 1997. This large and exceptional District, now on the National Register of Historic Places (under landscape architecture), contains 97 historic buildings and 60 historic structures (including most of the park's road system and the Wonderland and Northern Loop trails) as well as 31 other listed features. Together, these resources are considered to be the best example of park master planning in the National Park System. Collectively, they represent an important stage in National Park development history. At Mount Rainier in the 1920s and 1930s, the NPS Landscape Planning Division invented and defined modern National Park planning. Consequently, the Master Plan for Mount Rainier, completed in 1929, was the first National Park master plan developed by the NPS and it was and is considered a model of NPS planning. The degree of conformance to the plan still present in the park is outstanding. As a whole, no other collection of park roads, bridges, developed areas and trails is more completely preserved as an intact example of national park planning and design of the period 1904-1957. The goal, then as now, was to integrate all park systems and facilities in a unified plan that would ensure the best possible visitor experience while severely limiting how much development would be permitted in the park (Carr 1998). The master plan was executed in the rustic style of architecture and the naturalistic style of landscape architecture, using native materials and natural forms to blend constructed works with their environment.

The designation of a NHLD recognizes that the park does not simply contain individual historic resources, but is itself an historical park. The historic roads, trails, buildings and designed landscapes of the park together comprise a cultural landscape of national significance in American history. Twenty-nine cultural landscapes have been identified that occur in a variety of vegetation types on the north, south, east and west flanks of Mount Rainier. The significance of the NHLD is divided into the following categories, which recognize contributing resources:

- Spatial organization – the composition and sequence of outdoor spaces within the District;
- Circulation – the means and patterns of movement through the District;
- Topography – the ways in which the landscape planning responds to the topographic features of the site and the modifications of that topography;

- Vegetation – the response of existing vegetation as well as the management of vegetation through pruning, removal or addition of trees and shrubs;
- Structures – all contributing structures, including roads, trails and other small scale features such as rock walls and culverts; and
- Buildings – structures intended to shelter a human activity.

Approximately one-third of the park's cultural landscapes have had Level I or Level II Cultural Landscape Inventories completed (i.e. 10 of 29). Another approximately 20 Cultural Landscape Inventories and 25 Cultural Landscape Reports are needed to document known cultural landscapes. Even so, there is a great deal of known information that has not yet been documented through these formal inventory processes. Three Cultural Landscape Reports and three Development Concept Plans also document rehabilitation treatment for six cultural landscapes.

Recently, the Ohanapecosh administrative and visitor use area has also been determined to be eligible for listing on the National Register under the exceptional significance criteria as a cultural landscape that exemplifies the Mission 66 period of NPS development.

Visitor Experience

Located an hour and a half from metropolitan Puget Sound, Mount Rainier is not only within easy access of over two million people, it is also one of the most popular visitor attractions in the Pacific Northwest. About 80 percent of visitor use occurs between May and October (Johnson *et al*. 1990). The number of visitors to the park has varied little over the last 11 years.

Park visitation begins to increase in spring, peaks in July and August and decreases substantially beginning in October. During the peak season, park visitors regularly represent at least 40 percent and sometimes exceed half of all annual visitors (with over one million visitors counted in these two months alone). Visitation is therefore highly dependent on regional weather conditions. Visitors are drawn to the park from the surrounding region when the weather is clear and the mountain is visible, particularly on weekends. Visitation figures may also be dependent on the extent of road construction, flood damage or counting methods.

Visitors come to Mount Rainier National Park from all over the United States and from other countries. According to a 1990 survey (Johnson *et al.* 1991), the majority of park visitors were from Washington State (59 percent). Others were from California (5 percent), Oregon (3 percent), and other states (30 percent), with about 3 percent from foreign countries. The 2000 Visitor Use Survey (Simmons *et al*. 2001) similarly found that 60 percent were from Washington State, 5 percent from California, 3 percent from Oregon, but about 6 percent were from foreign countries.

There are five primary entrances to the park, including the Nisqually (southwest) – where approximately 54 percent of park visitors enter, Carbon River (13 percent of visitors)/Mowich Lake (13 percent of visitors) (northwest), Highway 410 (northeast)/Highway 410 (east) (26 percent of visitors) and Stevens Canyon (Highway 123/southeast) (16 percent of visitors) (Simmons *et al.* 2001). Developed areas are located throughout the park at Nisqually Entrance, Longmire, Paradise, Carbon River, Mowich Lake, Ohanapecosh, Sunrise and White River. Minor developed areas are located at Reflection Lake, Box Canyon, Tipsoo Lakes, and Grove of the Patriarchs, among others.

Most visitors travel by car, however a fair number come through on guided bus or van tours and a very small number use area shuttles for access to and within the park. There is no public bus transportation to the park and little currently within the park. Park visitors participate in a wide array of recreational activities, including camping, hiking, scenic driving, mountain climbing, skiing, snowshoeing, and walks to nearby viewpoints.

From 1985-2000, of the 14-23 percent of park visitors who stayed overnight, 14-29 percent camped in wilderness, 38-55 percent stayed in developed campgrounds, and 21-33 percent used overnight inns (Salvi and Johnson 1985, Johnson *et al*. 1990 and Vande Kamp, Swanson and Johnson 1999 and Simmons *et al*. 2001). Most (66-86 percent) park visitors come just for the day (Salvi and Johnson 1985, Johnson *et al*. 1990, and Simmons *et al*. 2001).

When visitors stay overnight, most (31 percent) stay one or two (26 percent) nights, while some (13 percent) stay three nights and 11 percent stay more than three nights (Simmons *et al*. 2000).

Wilderness

In 1988, Congress designated approximately 97 percent (228,480 acres) of Mount Rainier National Park as wilderness. Park wilderness includes a wide array of undisturbed lands encompassing ancient rainforest, pristine rivers and brilliant subalpine meadows. Park wilderness values include natural, ecological, geological, cultural, scenic, scientific and recreational opportunities. Natural quiet and natural darkness are also considered wilderness values. In the park, the wilderness boundary is generally located 200 feet on either side of the centerline of paved roads and 100 feet from the centerline of unpaved roads. Because wilderness is so extensive within the Park, any references to "backcountry" are synonymous with "wilderness".

Park wilderness offers a wide array of scenic, natural and ecological values. Park wilderness encompasses the full breadth of the diverse Mount Rainier landscape of glacial ice and snow, old growth forests, river headwaters, streams and waterfalls, abundant wetlands, flower-filled subalpine meadows and rock scree slopes with perennial snow patches. Park wilderness is and has been an ongoing object of scientific study. As the highest active Cascade volcano, exhibiting near-record snowfall and the greatest single-peak glacial system in the continental United States, the Mountain offers outstanding opportunities to understand vegetation, wildlife, fire ecology, catastrophic geologic events – including lahars, glacial outburst floods and volcanic eruptions – snow, ice and other water resources. These resources afford excellent opportunities to study ecosystem structure, function, processes and components across the breadth of this volcanic landscape.

Park wilderness cultural resources are also outstanding. As a premier National Historic Landmark District, the best example of implemented NPS planning in the early twentieth century, the park offers an outstanding opportunity to understand park-related human impacts as well as an unparalleled collection of rustic architecture and naturalistic landscape architecture. The park's human history is spread over nearly 8,500 years and offers glimpses into the distribution of people across a high mountain landscape over centuries of ecological changes in climate and topography.

Park wilderness also offers a range of recreational experiences – including camping, hiking, mountain climbing, backpacking, photography, picnicking, and a host of winter activities, including snowshoeing, cross-country skiing, sliding and snowboarding.

Most wilderness use occurs from June through September, especially on weekends and sunny days. During other months and many summer weekdays (except during the peak season), few people are encountered in the vast majority of the wilderness area (NPS 2002). There remain, despite heavy seasonal visitation, outstanding opportunities for solitude.

In addition to the GMP zoning, the Wilderness Management Plan (National Park Service 1989 as amended) uses management areas to enable increased operational efficiency. Wilderness Management Plan areas include trail, cross-country and alpine areas. The park contains approximately 37 designated trailside camps, 41 cross-country areas, and 19 alpine areas (including 4 alpine camps); each with varying limits for overnight use. The approximately 37 trailside camps contain about 25 group sites and 127 individual sites. The cross-country areas

have limits that specify the number of parties or the allowable number of people and vary from one to five parties (5 to 25 people in summer, 12-60 people in winter). Three relatively large areas, comprising approximately 41 percent of the park remain unlimited with respect to overnight camping. The alpine areas, including Camps Muir, Schurman, Curtis and Hazard, also have overnight limits – from two parties to 110 people. In addition, there are a number of no camping areas and zones, including any location within ¼ mile of a designated trail or road, the Butter Creek Research Natural Area, and the Paradise, Sunrise/Burroughs Mountain and Longmire areas in summer.

These limitations have allowed a large number of visitors to camp in the park, while protecting the resources they come to enjoy. Through the limits, impacts are concentrated into durable trailside and alpine camps, while dispersing use among the cross-country and alpine areas and increasing opportunities for solitude.

Park Operations

Park hazard tree management involves four phases: 1) Surveys, 2) Mitigation, and 3) Documentation. In the first phase the Hazard Tree Coordinator and/or Plant Ecologist) conduct surveys. Because not all areas within the park require a yearly inspection, the time necessary to complete the surveys varies from year to year.

In the second and third phases hazard tree treatments are carried out. This phase is of shorter duration, but involves more park staff. The park Road Crew is responsible for treating all designated trees in frontcountry areas, while the Trail Crew treats trees in backcountry or wilderness. In situations where the treatments cannot be safely or efficiently conducted by park staff, the Contracting Officer will authorize a contractor to complete the work. In all cases, if a site can be closed instead of cutting all or part of the tree, a variety of park staff (District Rangers, Fee Collectors, and Management Team) are consulted. Other park specialists including the Wildlife Ecologist, Environmental Protection Specialist, and Landscape Architect are also consulted, depending on the timing, location and extent of proposed treatments. The Hazard Tree Coordinator or Plant Ecologist is present during felling operations. The treatment phase generally requires 2 to 4 weeks to complete, depending on the number of treatments proposed.

The last phase involves the documentation of annual monitoring and treatments and also varies in timing and extent.

V. METHODOLOGY

NEPA requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. This section analyzes the environmental impacts of project alternatives on affected park resources. These analyses provide the basis for comparing the effects of the alternatives. NEPA requires consideration of context, intensity and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate impacts. In addition to determining the environmental consequences of the preferred and other alternatives, *Management Policie*s (NPS 2006) and Director's Order-12, *Conservation Planning, Environmental Impact Analysis, and Decision-making* require analysis of potential effects to determine if actions would impair park resources. Impact analysis for historic properties is based on NHPA 36 CFR Part 800 criteria of effect as detailed below.

Environmental Impact Analysis

The environmental consequences for each impact topic were defined based on the following information regarding context, type of impact, duration of impact, area of impact and the cumulative context. Unless otherwise stated in the resource section in Environmental Consequences, analysis is based on a qualitative assessment of impacts.

Context of Impact: Setting within which impacts are analyzed – such as the project area or region, or for cultural resources – the area of potential effects.

Type of Impact: A measure of whether the impact will improve or harm the resource and whether that harm occurs immediately or at some later point in time.

Beneficial: Reduces or improves impact being discussed.
Adverse: Increases or results in impact being discussed.
Direct: Caused by and occurring at the same time and place as the action, including such impacts as animal and plant mortality, damage to cultural resources, etc.
Indirect: Caused by the action, but occurring later in time at another place or to another resource, including changes in species composition, vegetation structure, range of wildlife, offsite erosion or changes in general economic conditions tied to park activities.

Duration of Impact: Duration is a measure of the time period over which the effects of an impact persist. The duration of impacts evaluated in this Environmental Assessment may be one of the following:

Short-term: Often quickly reversible and associated with a specific event, one to five years.
Long-term: Reversible over a much longer period, or may occur continuously based on normal activity, or for more than five years.

Area of Impact:

Localized: Detectable only in the vicinity of the activity.
Widespread: Detectable on a landscape or regional scale.

Cumulative impacts

Cumulative impacts are the effects on the environment that would result from the incremental impacts of the action when added to other past, present and reasonably foreseeable future actions. Impacts are considered cumulative regardless of what agency or group (federal or non-federal) undertakes the action.

The Council on Environmental Quality (CEQ) describes a cumulative impact as follows (Regulation 1508.7):

> *A "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person*

undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The cumulative projects addressed in this analysis include past and present actions, as well as any planning or development activity currently being implemented or planned for implementation in the reasonably foreseeable future. Cumulative actions are evaluated in conjunction with the impacts of an alternative to determine if they have any additive effects on a particular resource. Because most of the cumulative projects are in the early planning stages, the evaluation of cumulative impacts was based on a general description of the project.

Impact Mitigation

- **Avoid** conducting management activities in an area of the affected resource
- **Minimize** the type, duration or intensity of the impact to an affected resource
- **Mitigate the impact by**
  Repairing localized damage to the affected resource immediately after an adverse impact.
  Rehabilitating an affected resource with a combination of additional management activities.
  Compensating a major long-term adverse direct impact through additional strategies designed to improve an affected resource to the degree practicable.

All Impacts Except Special Status Species and Cultural Resources
Note: Special Status Species and Cultural Resources impact determinations are formally determined under the Endangered Species Act (Section 7) and the National Historic Preservation Act (Section 106), respectively.

Negligible: Measurable or anticipated degree of change would not be detectable or would be only slightly detectable. Localized or at the lowest level of detection.
Minor: Measurable or anticipated degree of change would have a slight effect, causing a slightly noticeable change of approximately less than 20 percent compared to existing conditions, often localized.
Moderate: Measurable or anticipated degree of change is readily apparent and appreciable and would be noticed by most people, with a change likely to be between 21 and 50 percent compared to existing conditions. Can be localized or widespread.
Major: Measurable or anticipated degree of change would be substantial, causing a highly noticeable change of approximately greater than 50 percent compared to existing conditions. Often widespread.

Note: Cultural resources impacts are also initially characterized as noted above, however the conclusion follows the format below, and makes a formal determination of effect under Section 106 of the National Historic Preservation Act. In accordance with National Park Service Management Policies (2006), the analysis in this Environmental Assessment fulfills the responsibilities of the National Park Service under Section 106 of the National Historic Preservation Act.

Special Status Species

No Effect: The project (or action) is located outside suitable habitat and there would be no disturbance or other direct or indirect impacts on the species. The action will not affect the listed species or its designated critical habitat (USFWS 1998).

May Affect, Not Likely to Adversely Affect: The project (or action) occurs in suitable habitat or results in indirect impacts on the species, but the effect on the species is likely to be entirely beneficial, discountable, or insignificant. The action may pose effects on listed species or designated critical habitat but given circumstances or mitigation conditions, the effects may be discounted, insignificant, or completely beneficial. Insignificant effects would not result in take. Discountable effects are those extremely unlikely to occur. Based on best

judgment, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects or 2) expect discountable effects to occur (USFWS 1998).

May Affect, Likely to Adversely Affect: The project (or action) would have an adverse effect on a listed species as a result of direct, indirect, interrelated, or interdependent actions. An adverse effect on a listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions and the effect is not: discountable, insignificant, or beneficial (USFWS 1998).

Cultural Resources Impacts

No effect: There are no historic properties in the Area of Potential Effect (APE); or, there are historic properties in the APE, but the undertaking will have no impact on them.

No adverse effect: There will be an effect on the historic property by the undertaking, but the effect does not meet the criteria in 36 CFR Part 800.5(a)(1) and will not alter characteristics that make it eligible for listing on the National Register. The undertaking is modified or conditions are imposed to avoid or minimize adverse effects. This category of effects is encumbered with effects that may be considered beneficial under NEPA, such as restoration, stabilization, rehabilitation, and preservation projects.

Adverse effect: The undertaking will alter, directly or indirectly, the characteristics of the property making it eligible for listing on the National Register. An adverse effect may be resolved in accordance with the 2008 NPS/ACHP/NCSHPO Agreement for Section 106 Compliance, IX, part C, by developing a memorandum of agreement in consultation with the SHPO, ACHP, American Indian tribes, and other consulting parties, to resolve the adverse effects (36 CFR Part 800.6(a)).

Significant Impact: An impact to a National Register historic property would be considered significant when an adverse effect cannot be resolved by agreement among SHPO, ACHP, American Indian tribes, other consulting and interested parties, and the public. The impact will diminish the integrity of location, design, setting, materials, workmanship, feeling or association characteristics that make the historic property eligible for inclusion in the National Register Historic Places. The resolution must be documented in a memorandum or programmatic agreement or the FONSI.

Impairment

In addition to determining the environmental consequences of the preferred and other alternatives, NPS Management Policies (NPS 2006) and Director's Order-12, Conservation Planning, Environmental Impact Analysis, and Decision-making, require analysis of potential effects to determine if actions would impair park resources. The following sections from Management Policies define impairment and highlight the difference between an impact and impairment.

1.4.3 The NPS Obligation to Conserve and Provide for Enjoyment of Park Resources and Values

The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. This mandate is independent of the separate prohibition on impairment and applies all the time with respect to all park resources and values, even when there is no risk that any park resources or values may be impaired. NPS managers must always seek ways to avoid, or to minimize to the greatest extent practicable, adverse impacts on park resources and values. The laws do give the Service the management discretion, however, to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, so long as the impact does not constitute impairment of the affected resources and values.

The fundamental purpose of all parks also includes providing for the enjoyment of park resources and values by the people of the United States. The enjoyment that is contemplated

by the statute is broad; it is the enjoyment of all the people of the United States and includes enjoyment both by people who visit parks and by those who appreciate them from afar. It also includes deriving benefit (including scientific knowledge) and inspiration from parks, as well as other forms of enjoyment and inspiration. Congress, recognizing that the enjoyment by future generations of the national parks can be ensured only if the superb quality of park resources and values is left unimpaired, has provided that when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant. This is how courts have consistently interpreted the Organic Act.

1.4.4 The Prohibition on Impairment of Park Resources and Values

While Congress has given the Service the management discretion to allow impacts within parks, that discretion is limited by the statutory requirement (generally enforceable by the federal courts) that the Park Service must leave park resources and values unimpaired unless a particular law directly and specifically provides otherwise. This, the cornerstone of the Organic Act, establishes the primary responsibility of the National Park Service. It ensures that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities for enjoyment of them.

The impairment of park resources and values may not be allowed by the Service unless directly and specifically provided for by legislation or by the proclamation establishing the park. The relevant legislation or proclamation must provide explicitly (not by implication or inference) for the activity, in terms that keep the Service from having the authority to manage the activity so as to avoid the impairment.

1.4.5 What Constitutes Impairment of Park Resources and Values

The impairment that is prohibited by the Organic Act and the General Authorities Act is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.

An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated. An impact that may, but would not necessarily, lead to impairment may result from visitor activities; NPS administrative activities; or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also result from sources or activities outside the park. . .

1.4.6 What Constitutes Park Resources and Values

The "park resources and values" that are subject to the no-impairment standard include:

- the park's scenery, natural and historic objects, and wildlife, and the processes and conditions that sustain them, including, to the extent present in the park: the ecological, biological, and physical processes that created the park and continue to act upon it; scenic features; natural visibility, both in daytime and at night; natural landscapes;

natural soundscapes and smells; water and air resources; soils; geological resources; paleontological resources; archeological resources; cultural landscapes; ethnographic resources; historic and prehistoric sites, structures, and objects; museum collections; and native plants and animals;

- appropriate opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing them;
- the park's role in contributing to the national dignity, the high public value and integrity, and the superlative environmental quality of the national park system, and the benefit and inspiration provided to the American people by the national park system; and
- any additional attributes encompassed by the specific values and purposes for which the park was established.

1.4.7 Decision-making Requirements to Identify and Avoid Impairments

Before approving a proposed action that could lead to an impairment of park resources and values, an NPS decision-maker must consider the impacts of the proposed action and determine, in writing, that the activity will not lead to an impairment of park resources and values. If there would be impairment, the action must not be approved.

In this Environmental Assessment determinations of impairment are provided in the conclusion section under each applicable resource topic for each alternative. Impairment determinations, however, are not made for health and safety, visitor use, maintenance, operations, socio-economic resources and other non-natural or cultural resources topics.

VI. ENVIRONMENTAL CONSEQUENCES

Impacts to Soils

Soils Impacts of Alternative 1: There would be negligible to minor localized short- and long-term adverse impacts associated with Alternative 1 on all types of soils. These impacts would include:

- soil compaction,
- disturbance or removal of plant cover, leading to an increased potential for erosion and
- soil mixing as, in some cases, stumps were removed.

These impacts would occur primarily where trees were felled. Soil compaction and soil mixing would also occur during revegetation. The impacts from tree felling activities would be similar to associated impacts from natural tree mortality. Because only a small number (up to 200) trees would likely be treated (including felled) each year these impacts would remain negligible to minor. To ensure that these impacts remained small, best management practices, such as felling trees back into the forest or toward existing paved areas and limiting the degree of trampling during monitoring would be employed. In general, however, trees would be felled in the direction they would fall naturally.

Soils Impacts of Alternative 2: Impacts and practices associated with this Alternative would be the same as Alternative 1 (including the possible number of trees removed), however with increased consistency in monitoring there would likely be an increase in the number of trees treated per year. Instead of an average of approximately 50 trees (as shown in Table 6) treated per year under Alternative 1, depending on hazard tree surveys and weather conditions the average would likely be somewhat less than the estimated 200 trees predicted to be removed per year.

Cumulative Impacts: Over time the areas where hazard tree survey and treatment would occur have been, in many cases, heavily impacted by trampling, construction of facilities, visitors (primarily campgrounds and picnic areas) and from the use of heavy equipment for maintenance and snow removal. Survey and treatment of hazard trees would add negligibly to these localized soil compaction and erosion impacts. When combined with other reasonably foreseeable projects that will occur or continue to occur in the park, such as road repair, building construction, facility replacement and day to day trail and road maintenance operations, there would be an indiscernible cumulative negligible to minor impact to soils.

Conclusion: The actions associated with Alternatives 1 or 2 would be negligible to minor and would not impair park soil resources or values.

Impacts to Vegetation

Discussion: Generalized Impacts to Wildlife and Vegetation from Forest Use, including Hazard Tree Management

Over time, treatment of individual hazard trees is expected to result in localized negligible to moderate and cumulative minor to moderate changes to plant community structure and functions, value to wildlife, and aesthetic values, depending on the location, number and size of trees removed.

Depending on the forest plant association or community type characteristics, resistance and resilience to administrative and visitor use of park forests varies. Natural tree failure may be related to environmental or mechanical conditions (such as temperature extremes, wind, snow-loading, lightning, excess soil moisture, soil compaction, undermined roots, leaning and/or human activities) or to biological conditions (diseases of tops, limbs, bole, butt or roots caused by insects, fungi, bacteria or mistletoes).

Franklin (1988) defines resistance as the ability of a habitat to tolerate human impacts, such as trampling, without undergoing major changes in community composition and structure – or the

"toughness" of the vegetative cover. Resilience is the ability of vegetation to recover once it has been destroyed or severely disrupted – often the productivity of a habitat. In general, most Mount Rainier forests generally have moderate to high resistance and moderate to low resilience. Herbaceous understory plants are noticeably less resistant than shrubs but may regenerate following disturbance; whereas shrub understory plants can tolerate moderate impacts, but once destroyed they are slower to recover.

Table 13 illustrates revegetation management considerations for forest communities as identified by Franklin (1988). The table shows that four communities have low resistance (TSHE/ACTR, TSHE/POMU, ABAM/TIUN, PSME/ARUV), thus it can be expected that large-scaled developments and disturbances would likely result in changes to understory communities, unless active management is taken to prevent such change. (See Appendix 4 for definitions of the plant community type names.) Table 13 also shows that the PSME/ARUV community has both low resistance and low resilience, implying that it is one of the most sensitive community types.

Areas with high fire frequency or some other frequent disturbance regime and with moderate to high resistance and resilience (ABAM/BENE, and ABAM/XETE) would likely be better sites for development since trees would generally be younger and less prone to developing defects and the communities are resistant to use, but regenerate readily when impacted. As shown in Table 11, few developments in the park occur in these communities. In several developed areas, the goal is to maintain an altered community such as the grass lawns in the Longmire Developed Area. Because most developments occur in vegetation communities with low resistance and/or low resilience, careful management must be taken if the community composition is to be maintained. In relation to hazard tree management, monitoring and treatment in these areas must be conducted in a manner that minimizes off-trail/road travel.

Vegetation Impacts of Alternative 1: Under Alternative 1, impacts to plant community structure and functions from hazard tree management would be localized and would consist of the loss of individual trees, and therefore would continue to be negligible to minor . Trees would be felled or removed as funding allows. In a typical year, plus or minus one campground gets treated per year, and the campground(s) selected for treatment are prioritized according to level of hazard and/or impacts of closure to the need for public facilities.

Initial impacts associated with the removal of just over 450 trees throughout the park would be as follows. The topping or removal of ten or fewer trees at Box Canyon, Nisqually Road, Sunshine Point Campground, Tahoma Woods, Grove of the Patriarchs, Kautz Creek Picnic Area, Nisqually Entrance, Ohanapecosh Administrative Area, Mystic Lake, and Paradise River would result in a negligible, localized adverse effect on area vegetation structure and diversity. The topping or removal of approximately 10-50 trees at Cougar Rock Campground and picnic area, Ipsut Creek Campground, Longmire Administrative Area and campground, White River Campground and entrance, and Lake George would result in a minor, localized effect on vegetation structure and diversity. And, the topping or removal of nearly 200 trees in the Ohanapecosh Campground (that would, if co-located would total approximately 1 ½ acres in an area of over 67 acres or about 2 percent) would result in a localized moderate effect on structure and diversity and a negligible effect on the forest communities affected by treatment. At the current rate of funding available for hazard tree removal, this plan would occur over the course of 10 years. If funding is secured to treat more areas, this plan may occur within two to four years.

In some campgrounds and picnic areas there may be a lack of understory and/or low regeneration of understory due to soil compaction due to trampling and the creation of social trails. . Without adherence to a revegetation strategy, forest vegetation in developed areas would continue to be moderately affected by human impacts. Cyclic rehabilitation of campgrounds (which is primarily focused on improving the visitor use facilities), would provide opportunities to minimize trampling and social trail development through the intentional placement of large wood to facilitate the restoration of vegetation between campsites or picnic sites.

Over time, the cumulative effect of removing hazard trees may locally shift the composition of tree species and size classes. Analysis of hazard trees in the park has shown that most tend to be western hemlock, somewhat fewer are Douglas-fir, and significantly fewer are western red cedar and other species. Without active revegetation under this Alternative, over time the loss of these dominant species may result in a change in the relative abundance of these species within park developed areas, where most hazard tree removal would occur.

Because trees in park forests are long-lived and despite being called "old-growth" are actually comprised of a wide range of ages, even systematic removal of hazard trees over time would not be noticed by most visitors for many years. This is also true because it would be highly unlikely that all trees in a particular area would become hazardous at one time, unless affected by catastrophic fire, insect damage or a partial blow-down. Therefore the visual impact of tree removal would depend on how extensive hazard tree removal was and whether numerous trees were identified in a compact area. The practice of leaving most trees to decay in place would continue to contribute to the establishment of understory vegetation and ensure recycling of nutrients in forests routinely affected by human impacts.

While initial impacts would be negligible to minor, cumulative impacts could range to moderate. Without systematic replanting of past and future areas affected by hazard tree removal, the forest would retain limited structural diversity over time. Without or even with tree replacement, forested developed areas could change from rather dense forest to more open areas over time as the senescence of older trees continued. Under Alternative 1, despite plans calling for replanting of trees removed, little has been accomplished and this practice would be expected to continue.

Despite the potential for cumulative impacts, overall, little effect on park developed areas from hazard tree management can be demonstrated from actions taken since the park was established. Rather, the greatest impacts have resulted from the creation of the developed facilities themselves. For example, creation of Ohanapecosh Campground resulted in the removal of many trees in the 1920s and 30s and then in the 1960s (depending on which loop). Since establishment, many trees have also fallen naturally while some have been removed as hazards. More than 40-70 years have passed following campground placement and despite inconsistent attention to replanting under this Alternative, much of the forest retains the old-growth characteristics (large diameter tall trees, undergrowth between sites, fallen nurse logs) which originally drew planners and campers there.

Vegetation Impacts of Alternative 2: Most impacts associated with this Alternative would be the same as Alternative 1. The following analysis highlights the differences, which primarily can be attributed to increased monitoring, greater analysis of defects in monitoring, increased systematic analysis and implementation, more comprehensive data collection and documentation, a specific process to make individualized treatment decisions, an increase in the number of options available for treatment and more attention to tree replacement/revegetation.

Under Alternative 2, with a formal hazard tree management program in place to identify potential risks and to mitigate tree removal with replanting, initial impacts would be negligible to minor as in Alternative 1, but long-term and cumulative impacts would be improved. With analysis of the composition of the forest included in this alternative, revegetation strategies would focus on maintaining the existing vegetation composition and density as documented by ongoing analysis of forest communities in the park. As a result, the goal of the Hazard Tree Management Plan is to allow the forest to retain its structural and species diversity over time, with many old and some young trees. Because treatment decisions would be made with a step-down process taking all non-removal options into account before advocating removal, effective hazard tree treatment may even result in removing only portions of trees (such as tops or limbs) rather than the whole tree for minor defects as in Alternative 1. Where topping occurs, the major portion of the tree bole (snag) remains as a "habitat" tree, maintaining structural diversity usually not present in developed forest landscapes (where such snags are often immediately removed as hazards). As

in Alternative 1, felled trees would primarily be left in place to increase opportunities for natural revegetation and to (in campgrounds and picnic areas) add to the distinction between sites. Some however would be used for other purposes, such as trail or historic structure rehabilitation as described above.

Mitigating the effects of human impacts when combined with the periodic removal of hazard trees will require a long-term commitment to not just replanting trees, but also understory vegetation (depending on the resilience of the plant community in question). In most locations, however, natural regeneration of resilient forest understory species would occur without restoration intervention once the trees are restored and site impacts cease. Where site impacts would continue, such as in campgrounds and some developed areas, there would need to be a greater commitment to ensuring that replanted trees persisted over time in the environment, with a likely higher replacement ratio needed than in areas where the trees are more protected from human impacts.

Long-term (Cumulative) Impacts of Park Hazard Tree Management (Alternatives 1 and 2)
Discussion
To describe the long-term effects of hazard tree removal on park vegetation, it is important to understand the relationship between the potential removal of individual hazard trees and the persistence of the forest plant association or community of which they are part. Each major developed area within the park was analyzed to determine the *worst case scenario* impact that removal of all trees (clearcutting) within that affected area could have on the presence of the community type(s) or plant association(s) compared both to the affected watershed and to the rest of the park (*Appendix 3* Forest Plant Associations, Community Types and Phases and Table 14: Summary of Potential "*Worst Case Scenario – 100% tree removal*" Impacts below).

The worst case scenario analysis is presented in Table 14. *It is important to note that these numbers reflect an amount of tree removal that is far greater than would occur under this plan.* As noted earlier, actions that would be undertaken as a result of this plan are actions that would affect less than 10 percent of the trees in an area at one time or over time. The comparison to this worst case scenario, however, is useful to show the relative importance, or significance, of that forest community or plant association by its prevalence in the watershed and in the park. As indicative of a worst-case scenario, the percentages reflect how much of the total forest community or stand would be lost if all trees within developed areas were removed (as noted above, this is an action that would <u>not</u> occur under this plan).

Because only individual trees would be removed over time, actual impacts would be far lower than the numbers indicated in Table 14. Understanding how the development of park facilities has affected forest plant associations and communities is key to determining the effects of these developments (and the actions that impact them, such as hazard tree removal) on the preservation of unique park resources not just associated with the hazard tree plan, but also to ensure management for future generations (and therefore non-impairment) under the NPS Organic Act.

<u>Method</u>
First, major developed areas, including the Carbon River Entrance, Tahoma Woods, Nisqually Entrance, Longmire, Paradise, Stevens Canyon Entrance, Ohanapecosh and the White River Entrance, were analyzed to determine which forest community types (according to Franklin 1988) were present. These forest communities were then further divided into stand age classes. Thus, a silver-fir/Alaska huckleberry (ABAM / VAAL) community of 300 to 400 years was differentiated from silver-fir/Alaska huckleberry community that was 500 to 600 years old.

Table 13: Management-related Features of Various Forest Habitat Types at Mount Rainier National Park
(from Table 20 Franklin *et al.* 1988)

bitat pe	Physical Conditions			Biological Conditions			Natural Disturbances			Development Potential		
	Growing Season	Drainage	Snow pack	Productivity	Plant Diversity	Wildlife [#]	Specimen Trees[&]	Fire	Pathogen	Wind[^]	Resistance	Resilience
HE / TR	L Long	W Well	I Intermittent	H High	M Moderate	OG, U, A		M-H	BB Bark beetles		L Low	M Moderat
HE / MU	L	W	I	VH Very high	M	OG, U, A	P	L Low		H	L	H High
HE / HO	L	W-P	I	VH	H High	OG, U, A	P	L		H	M Moderate	H
AM / HO	M Medium	W-P	M Moderately deep	H	H	OG, U, A	P	L		H	M	H
AM / N	M	W	M-D	VH	H		P	M Moderate			L	M
AM / AL	M	W	M	M Moderate	M	OG	P	L			H High	M
HE / SH	L	E-W	I	L Low	L Low	U		H high	DM Dwarf mistletoe		H	L Low
AM / SH	M	E-W	M	L	L			H	DM		H	L
AM / NE	M	W	M	M	L			H	BB		M	M
AM / TE	M	W	M-D	M-L	L			H	BB		H	M
AM / LA ULA)	S Short	W	D deep	M-L	M(H)			M			M	M
AM / LA RMO)	S	W	D	M-L	M(H)			L			M	M
NO / OV	S	P poor	M-D	L	M-H	A		L		H	M	L
AM / AL	S	P	D	L	M		P	L		H	M	L
AM / FE	S	P	D	M-L	M			M			M	M
ME / UV	M	E excessively	I-M	VL Very low	M			H	DM		L	L

[#] OG – Important to old-growth temperate animal species
U – Ungulate winter habitat
A – Important amphibian habitat
[&] P – Presence of unusually large or old trees
[^] H – High potential for wind throw

As shown in Table 14, column 4, the Carbon River Entrance is comprised of a 500-600 year old *Tsuga heterophylla* (western hemlock)/*Oplopanax horridium* (devil's club) (TSHE / OPHO) community. The Longmire Administrative Campground is primarily comprised of two different communities, one with two different stand age classes – *Tsuga heterophylla*/*Gaultheria shallon* (salal) (TSHE / GASH) of 300-400 years and of 700-1000 years as well as *Pseudotsuga menziesii* (Douglas-fir)/*Arctostaphylos uva-ursi* (kinnikinnick) (PSME / ARUV) of 300 to 400 years.

Next, the acres that would be affected in a worst case scenario in each developed area were calculated (columns 5 and 6). This allowed analysis of the number of acres of each forest community and/or forest stand type that a developed area occupied. As shown in Table 14 below (column 4) and as noted above, many park developed areas occupy more than one forest community and/or stand age type.

Finally, for each developed area where hazard tree removal would occur, the worst case scenario effects on both the forest community and the age classes within that community (forest stands) were calculated both for the affected watershed and the park as a whole. *Note: The impacts to the watershed areas were only calculated as they affect areas protected within the park boundary – some of these watersheds, however also extend outside the park.*

Table 14 (columns 5 and 6) identifies the maximum percentage of habitat that would be affected if all trees within identified park developed areas were removed. Column 5 is the total percent of the forest community affected – for example in Row 1, how would removing this community in the Carbon River Entrance affect the whole western hemlock/devil's club community (regardless of age) in the park or in the Carbon River Watershed within the park? Column 6 shows what impacts would occur in the western hemlock/devil's club 500-600 year old age class and what part of the park and the Carbon River Watershed they would affect. (The percent of forest community is calculated against the prevalence of that community type in the park. Similarly the percent of forest stand affected is calculated against the prevalence of that type of stand age class in the park.)

<u>Greatest impact to a community type under the worst case scenario (greatest possible impact – 100% tree removal – to most sensitive community)</u>
Using Table 14, for example, total removal of trees in the Longmire Administrative Campground area would result in a loss of 6.29 percent of the PSME / ARUV community in the park and 9.99 percent of the total PSME / ARUV community within the Nisqually River Watershed. This community is all the same age (300-400 years). Therefore, if total removal were to occur, it would result in a loss of 15.02 percent of all 300-400 year PSME / ARUV stand area within the park, and 15.02 percent of all these stands of 300-400 year old PSME / ARUV within the Nisqually River Watershed. While these numbers seem somewhat moderate (between 6 and 15 percent) when compared to the prevalence of this community type in the park, the effect of this worst case scenario removal localized in the Longmire Administrative Campground area could be devastating, depending on the ability of this community to regenerate from its own or other nearby source areas in the Nisqually River Watershed.

<u>Least impact to a community type under the worst case scenario (least possible impact to most abundant community)</u>
Using Table 14, total removal of trees in the 300-400 year old age class of ABAM / TIUN in the Mowich Lake Campground area would result in a loss of 0.003 (three thousandths of a percent) of this community within the park and 0.02 (two hundredths) percent of this community in the Mowich River Watershed. This would also result in a loss of 0.02 percent (two hundredths) of this stand age class in the park and 0.04 (four hundredths) percent of this stand age class in the Mowich River Watershed.

Summary of Worst Case Scenario Approach/Cumulative Impacts of Hazard Tree Program
With few exceptions, using this extreme worst case scenario, it is clear that removal of approximately one acre of individual trees per year (in different age classes and from different forest community types) parkwide would have little cumulative effect on the presence of either the forest stands occupied by park developed areas or on the presence of those forest communities in the park, especially when revegetation (as in Alternative 2) is employed. For most watersheds, even removing all the trees within the developed areas affected by this plan would result in only minimal loss of habitat, when compared to not only the surrounding watershed, but also the park. This is partially true because park developed areas occupy only a small percentage (three percent) of Mount Rainier National Park as a whole.

The exceptions include the potential long-term (cumulative) effects of hazard tree removal in the Longmire Administrative Campground, where the two dominant community forest stands comprise a large segment (in some cases from 10 to just over 15 percent) of those known from the park. Under the worst case scenarios as noted above and shown below, removing all the trees in 300-400 year old age class of PSME / ARUV (Douglas-fir/kinnikinnick) community in the Longmire Administrative Campground could result in loss of 10 percent of that community within the Nisqually River watershed (within the park boundary) and approximately 6 ¼ percent of that community within the park. This same loss would comprise a loss of approximately 15 percent of that stand age class within the Nisqually River watershed (within the park boundary) and the same loss within the park. If this occurred, the loss would likely be considered major. Because, removal of all of that age class is not planned and because the sensitivity of this area is known now, greater adherence to techniques that minimize hazard tree removal would be undertaken in this area. In addition, under the conditions in this Hazard Tree Plan/Environmental Assessment, the removal of more than 10 percent of the trees at one time or over time in a particular area would require additional environmental analysis to determine consistency with conditions of approval associated with this plan.

Table 14: Summary of Potential "*Worst Case Scenario*" Impacts for Alternatives 1 and 2 (No Action and Preferred Alternative as a percentage of total acres in location or park)

Park Area	River Watershed	# Acres Potentially Affected	Forest Community and Age of Stands	percent Forest Community Impacted		percent Forest Stand Impacted	
				Park	Watershed	Park	Watershed
Mowich Lake Campground	Mowich	4.6	ABAM/RHAL 300-400 yrs	0.002	0.04	0.01	0.04
			ABAM/TIUN 300-400 yrs	0.003	0.02	0.02	0.04
			ABAM/XETE 300-400 yrs	0.01	0.13	0.06	0.32
			ABAM/MEFE 300-400 yrs	0.04	0.38	0.15	0.78
Tahoma Woods	Nisqually			-----	------	------	-------
Nisqually Entrance	Nisqually	8.9	TSHE/POMU 100-200 yrs	0.30	0.93	1.33	1.33
Sunshine Point Campground	Nisqually	9.8	TSHE/POMU 100-200 yrs	0.33	1.02	1.46	1.46
Longmire	Nisqually	19.4	ABAM/TIUN 100-200 yrs	0.08	0.46	0.6	2.09
			TSHE/GASH 100-200 yrs	0.36	1.11	1.58	1.58
Longmire Administrative Campground	Nisqually	36.0	TSHE/GASH 300-400 yrs	0.48	3.63	13.51	5.73
			TSHE/GASH 700-1000 yrs	----	-----	2.28	2.72
			PSME/ARUV 300-400 yrs	6.29	9.99	15.02	15.02
Cougar Rock Campground	Nisqually	48.2	ABAM/VAAL 700-1000 yrs	0.18	1.49	0.77	4.23
Paradise	Nisqually	2.4	ABAM/RULA 300-400 yrs	0.01	0.16	0.08	0.20
Stevens Canyon Entrance	Ohanapecosh	7.5	ABAM/VAAL 200-300 yrs	0.03	0.10	0.44	0.62
Ohanapecosh Campground	Ohanapecosh	67.7	ABAM/VAAL 200-300 yrs	0.02	0.09	0.38	0.53
			TSHE/ACTR 200-300 yrs	1.16	1.47	1.63	1.63
			TSHE/GASH 200-300 yrs	1.76	3.90	4.13	4.14
Ohanapecosh Administrative Area	Ohanapecosh	16.9	TSHE/ACTR 200-300 yrs	0.68	0.86	0.95	0.95
			TSHE/GASH 200-300 yrs	0.41	0.90	0.95	0.95
White River Entrance	White	13.4	ABAM/VAAL 500-600 yrs	0.05	0.55	0.28	0.96
White River Campground	White	32.0	ABAM/VAAL 400-500 yrs	----	----	0.23	7.86
			ABAM/VAAL 700-1000 yrs	0.14	1.56	0.50	10.09
Sunrise	White	24.2	N/A	----	----	----	----
Carbon River Entrance	Carbon	10.1	TSHE/OPHO 500-600 yrs	0.35	1.44	1.02	1.45
Ipsut Creek Campground	Carbon	8.8	ABAM/OPHO 500-600 yrs	0.20	0.75	0.78	1.11

Notes:
1) Percent Forest Community Impacted is calculated as the area of that forest community (in acres) within the developed area divided by the total area of that forest community found within the park or watershed multiplied by 100. Forest community type acreages are from Table 11.
2) Percent Forest Stand Impacted is calculated the same way (# acres in developed area divided by that stand age class in the park and watershed).

Vegetation Cumulative Impacts of Alternative 1: Because the park is approximately 97 percent wilderness and developed areas comprise a small portion of the remaining three percent (or approximately 7,069 acres) and because generally less than 2 percent of the forest communities and less than 2 percent of forest stands within these communities could be affected by hazard tree removal impacts associated with hazard trees, selective removal of hazard trees would not be significant. As noted in Table 14, even if all trees were affected in a particular hazard tree survey and treatment area, the effect would be negligible to minor in the majority of developed areas, ranging to moderate or major, with approximately 15 percent of the known forest community age class that could be affected within the Longmire Administrative Campground.

Because old growth forests in the park are comprised of trees in many age classes, all trees would be extremely unlikely to become hazardous at one time unless affected by a catastrophic event (an effect outside the scope of this plan). Over many years, it would likely be possible, however, to note a change in the size and number of large trees in a particular area, as has been noted in Ohanapecosh Campground. This could constitute a minor to major impact, depending on the scale of removal in the location in question. When the effects of localized negligible to minor tree removal that occur in the park are combined with the deforestation that has occurred surrounding the park, a moderate cumulative impact results, making the importance of protected areas like Mount Rainier National Park even greater.

Vegetation Cumulative Impacts of Alternative 2: Impacts would be similar to Alternative 1. In the proposed Hazard Tree Plan the decision-making process would likely contribute not only to preservation of the forest community, but also to preservation of the aesthetic and ecological values within each site. In addition, as appropriate, under this Alternative, individual projects comprising the removal of 10 percent of an area's trees (at one time or over time) would also undergo additional environmental analysis to determine their consistency with conditions of approval.

Conclusion: Alternative 1 would result in short-term negligible to moderate localized impacts in developed areas, with negligible to minor, occasionally ranging to moderate long-term/cumulative impacts on forested plant associations or communities. Alternative 1 would not likely result in replanting of trees, while Alternative 2 would not only result in revegetation, but also in a more conscious decision-making process that would contribute to better long-term preservation of the park's forest ecosystems. Even so, Alternative 2 could result in minor to moderate cumulative localized impacts. Because of the mitigation strategies associated with decision making and revegetation in Alternative 2, major impacts would be unlikely to occur during the life of this plan.

When the vegetation impacts associated with the hazard tree removal were added to the localized vegetation impacts from tree removal for other purposes (building and road rehabilitation and construction and other projects noted in the cumulative effects section where alternatives to tree removal are carefully considered in separate environmental analysis), cumulative effects would be remain localized and negligible to moderate within the park and widespread negligible to major outside the park. No impairment of park vegetation or values would occur under either alternative.

Impacts to Wildlife

Impacts of Alternative 1: Under this Alternative, the removal of hazard trees from park administrative and developed visitor use areas would continue to result in a localized loss of trees that contribute to cover, forage, roosting and nesting areas for wildlife. Removal would also continue to impact wildlife by occasionally increasing noise and disturbance in areas already affected by human use. These impacts would be greatest (moderate) in areas where large numbers of trees are identified for treatment in a compact area and least (negligible) where individual removal of trees occurs widely spaced over time. Because replacement of trees has not occurred despite plans, the effect of hazard tree removal over time has contributed incrementally to the continued decline of developed areas as effective wildlife habitat. When compared to the historical effect of converting park forests to developed areas, effects of

removing hazard trees from these areas, even over time would continue to result in a minimal, negligible effect on wildlife. Stated another way, more impacts have occurred and would continue to be present more as a result of the use of a formerly intact forested area for administrative or visitor uses than would occur from the additional occasional and incremental removal of trees in those same areas over time. Wildlife that did not tolerate the conversion of these forested areas to other such uses or that used these developed areas as their primary breeding, roosting and foraging area have long-since diminished or relocated, particularly during the primary visitor use season, while wildlife that are more habituated to or that can tolerate human activities would continue to frequent and sometimes thrive in these areas, particularly during low visitor or employee use periods (at night and in winter). For most wildlife, however, the effects of development of less than three percent of the park for visitor and administrative uses, has had only a negligible long-term effect.

Impacts of Alternative 2: Impacts associated with this Alternative would be similar to Alternative 1, however, with the added possibility of topping, rather than removing trees, there would be increased availability of snags to some species (such as woodpeckers or cavity nesting birds) to meet habitat requirements, when the wildlife are tolerant of human use or when these activities may be conducted during low periods of visitor use (at night and in winter). In addition, the replacement planting of trees lost to hazard tree removal would maintain portions of the forest in an early stage of succession, adding diversity to the forest age structure and increasing browse for ungulates. To minimize impacts associated with hazard tree removal, trees proposed for removal would be removed primarily in fall (outside of rare bird nesting seasons) and would, as noted, mostly be left in place to decay naturally. Because most trees that would be removed by the park would have been expected to fall within a few years time without treatment, the actual effects of their early removal through human intervention would be minimal. The successful establishment of planted trees, which may require active protection and care, will further ensure only negligible to minor effects. Where revegetation is necessary to restore areas that were either not planted or where planted trees did not become successfully established following previous park management activities, or where a large number of trees were removed from the same area effects of planting may be more detectible.

Cumulative Impacts: Consistent and long-term removal of hazard trees may result in vegetation changes that affect wildlife, including in the types and numbers of trees, number of snags, size of trees and other effects. These effects would be similar to the localized effects described above. Because, park developed areas comprise approximately three percent of the park and similar habitats (including similar vegetative structure and diversity is widely available outside of these areas) and because these areas, despite facilities continue to provide habitat, the effects of ongoing treatment of park hazard trees would continue to be minor in contrast to effects from continuing existing uses. When these effects are added to the effects of the rather widespread logging/habitat removal outside the park, they would contribute only a negligible impact to the moderate to major cumulative effect outside the park and minor localized effect in developed areas inside the park.

Conclusion: The actions associated with Alternatives 1 or 2 would not impair wildlife or the values for which they have been protected in Mount Rainier National Park.

Impacts to Special Status Species

SPECIAL STATUS PLANTS

Impacts of Alternatives 1 and 2: No special status plant species populations are known to occur in the areas where hazard tree treatment would occur. While some sensitive plant species do occur in developed areas, such as the Longmire Administrative Campground, analysis of their locations has determined that they would be unaffected by any proposed hazard tree removal. The location of the plants in the Longmire Campground, for instance, is not near areas of current or proposed uses that would comprise targets in the area. There would be no effect on special status plants from the effects of hazard tree removal.

Cumulative Impacts: No effect on and no additional cumulative effects to sensitive plants would occur. Proposed road rehabilitation activities are planned along the Stevens Canyon Road (2011), the Nisqually to Paradise Road (2012-2013), and State Route 410 (2010). These projects have the potential to affect individual sensitive plants; however, the hazard tree management activities proposed under both alternatives is not expected to contribute to any cumulative effects that may occur as a result of the implementation of road rehabilitation projects.

Conclusion: There would be no impacts to and no impairment of special status plants or their values from the actions associated with Alternatives 1 or 2 in this Environmental Assessment.

Special Status Wildlife

Impacts of Alternatives 1 and 2 (differences noted within): In addition to the general impacts noted above under *Wildlife*, the following determinations of effect have been made for special status wildlife species (for effects to other than northern spotted owls and marbled murrelets see also *Affected Environment Special Status Species* section).

Impact Factors for Determining Effects to Northern Spotted Owls and Marbled Murrelets
It is very difficult to assess the impacts of disturbance, or how several factors might cumulatively increase the degree of impact on any wildlife species, particularly birds. The primary issues surrounding disturbance impacts from the hazard tree management program are the noise produced and the potential for that noise to disturb nesting birds. The potential for disturbance varies with the type of equipment. Generally equipment includes chainsaws, used to cut trees and heavy equipment (front end loader and dump truck) used to remove felled trees that cannot be left in place. The potential for this disturbance to affect particular birds also varies with the season, ambient noise level and duration, scope and intensity as well as with vegetation and topography.

Noise: In assessing impacts of noise on birds, the maximum noise level, the equivalent noise level (the level of a continuous sound with energy equal to the noise in question), the median level and the ambient noise level are all considered. Both the decibel level and the frequency spectrum of the noise are also important in assessing the impact of a noise. The following factors, in order of importance, determine how noise travels across a landscape: distance, wind speed and direction, temperature and humidity, surface quality (softness or hardness), topography and vegetation.

Response: Animals do not perceive sounds the same as humans do. For example, owls tend to be more sensitive in the middle frequencies than humans, but less so in the lower frequencies (Delaney 1999). Analysis of impact must be made on a species specific basis, or use a closely similar species as a surrogate. An animal's response varies with the following factors: decibel level, duration, number and frequency of events, variation in decibel level over time, rate of onset, background noise, frequency distribution of the noise energy, reproductive status/stage, prior experience, visibility of source, presence of predators, position of animal relative to source, age, gender, and individual temperament. The dose response (whether or how long it takes a species to respond to a particular noise) will vary for each combination of noise and species.

Equipment: With regard to equipment, the emphasis should be placed on the loudness and suddenness of the noise produced. Obviously, for visual types of disturbance, loudness may not be important; suddenness may be more important.

For the purposes of section 7 consultation on listed birds, USFWS and park staff has divided management tools into groups based on the level of noise they produce: 1) non-motorized hand tools; 2) motorized hand tools; 3) heavy machinery; and 4) blasting. Non-motorized hand tools produce very little noise and most will likely not disturb a species even if used during the breeding season. Motorized hand tools, including chainsaws, produce more noise that can be heard over a distance. Heavy machinery, including front-end loaders, and dump trucks, will produce noise above regular autos and recreational vehicles. In some campgrounds within the park, the level of

noise produced by heavy machinery would be above ambient. Blasting using explosives produces high intensity and abrupt noise that can be heard for long distances.

Ambient: The background level of noise and/or visual cues is known as the ambient level. Ambient noise can be caused by natural sounds such as stream noise, or can be caused by consistent human generated noise such as traffic sounds. Ambient visual levels can be caused by natural movements such as that generated by wind, rain, or other animals; or can be caused by consistent human generated movement such as traffic, or seasonal campground use. These can vary seasonally as weather, water levels and traffic patterns change. Animals living near constant ambient noise and movement sources may become habituated to those sounds/visual cues and are unlikely to be disturbed by that which falls within the range of the existing ambient level.

Topography: Topography can affect how sound carries; sound carries further over flat ground, or from a high point of ground. A ridge can serve as a buffer to noise and visual disturbance; a canyon can contain and amplify noise disturbance.

Vegetation: Sound does not carry as well or as far through vegetation as it does over open ground. Sound will carry much farther over meadows, wetlands, and especially open bodies of water. Thick vegetation may serve as a buffer from visual disturbance and under some circumstances from noise disturbance as well.

Weather: Weather conditions may influence how well and how far sound travels. Wind may carry sound further. High ambient noise from wind or rain may mask noise. In Mount Rainier National Park, cloudy conditions with precipitation and wind are common during all times of year, particularly during the early breeding seasons for northern spotted owls and marbled murrelets.

Intensity: A noise or visual disturbance that starts low and builds, such as a vehicle driving down a road which approaches a nest area, would likely result in different risks than a sharp blast, or an intense noise, such as operation of a chainsaw or other loud equipment. Generally it is thought that lower intensity noise or visual disturbance results in less risk to species than higher intensity noise or visual cues, or noise disturbance from a sharp blast.

Duration: The length of time over which unaccustomed noise or visual disturbances occur might affect how species respond to the disturbance. Generally it is thought that noises or movement of shorter duration would pose less risk to species than longer duration noises or movement. At some point, species or individuals might become accustomed to some long-term constant noise and movement, and if so, risks to species would decrease.

Scope: The scope of disturbance or habitat modification impacts is also considered to assess risks to a population or meta population. In general, impacts of like kind are smaller in scope, would affect less occupied or potentially occupied habitat, and would pose less risk to species than impacts which are larger in scope. The scope of impacts on populations is generally impossible to consider when assessing individual projects. This multi-program programmatic consultation allows biologists to track and consider risk to species from the scope of all activities with potential impacts.

Direct and Indirect Effects

Direct effects considered in this biological assessment include the effects related to noise and disturbance, as discussed in the previous section, and effects related to loss of habitat.

Conservation Measures

To minimize the potential for effects on species dependent on old-growth forest characteristics, including the northern spotted owl and marbled murrelet, as well as other wide-ranging mammals, the following measures would be implemented as part of the park's hazard tree management program:

General Conservation Measures

- (Backlog) The removal of hazard trees would primarily consist of individuals in widely dispersed areas within the park.
- Treated trees would be those that would be likely to fall, without treatment, within about five years.
- (Alternative 2) Removal of more than ten percent of the trees in an area at one time or over time would require separate environmental analysis to determine consistency with the effects concluded in this analysis.
- (Alternative 2) Every effort would be made to consider options other than tree removal in the decision-making process.
- Trees targeted for removal would be surveyed by wildlife and/or cultural resources staff, as appropriate, prior to treatment to determine unique characteristics such as favorable conditions for northern spotted owls or marbled murrelets and/or other wildlife habitat or cultural characteristics.
- No habitat trees would be removed from the Carbon River Entrance, Ipsut Creek Campground or Cougar Rock Campground between March 15 and September 30. If hazard trees are present after the winter and cannot be treated before March 15, the site will be closed for the summer and the tree treated after September 30. There may be downed trees that need to be removed from the campgrounds between March 15 and September 30. If this occurs then this will be done between two hours after sunrise and two hours before sunset.

Northern Spotted Owls and Marbled Murrelet Conservation Measures

- Trees would not be felled between March 15 and September 30 unless a no effect determination could be supported.
- Downed trees and hanging trees would be removed during spring opening (May to June). If chainsaws are used, this activity would occur between 2 hours after sunrise and 2 hours before sunset and would be greater than 65 yards from any northern spotted owl 0.7 mile activity circle.
- Although no northern spotted owl nests/activity sites have been found in any of the developed areas affected by the Hazard Tree Management Plan, there is the potential to remove suitable northern spotted owl habitat within these areas. The extent of the removal will be small, and would occur outside the activity sites.

Note: Occurrence and impact information is presented in the Affected Environment section (and summarized below) for the following species: gray wolf, grizzly bear, Canada lynx, bald eagle, bull trout, and Puget Sound chinook. Effects on northern spotted owls and marbled murrelets are presented in detail below.

There would be no effect from the implementation of the Mount Rainier National Park Hazard Tree Management Program on the following species: gray wolf, grizzly bear, Canada lynx, bald eagle, bull trout or Puget Sound Chinook.

Effects of Proposed Actions on Northern Spotted Owl and Marbled Murrelet

Northern Spotted Owl

Direct effects to the northern spotted owl relate to disturbance impacts from noise and human presence, and direct loss of habitat from project work.

Wasser *et al.* (1997) researched physiological stress response in spotted owls. They documented a significant increase in fecal stress hormones in adult males where territories were within 0.25 miles (0.41 kilometers) from a major logging road or recent (10 years to present) timber activity. Further, in adult females, fecal stress hormones more than doubled during the June through mid-July fledging period. This study suggests that stress impacts caused by disturbance in the vicinity of owl territories may be more significant than previously thought.

Most of the hazard trees removed in the park are not suitable for spotted owl use. Only about 20 percent of the hazard trees removed each year as a result of the routine monitoring program are live conifers above 20 inches DBH (although approximately 60 percent of the backlog trees are this size).

Timing**:** As noted in *Affected Environment*, for impacts analysis purposes, the breeding season for spotted owls is divided into early and late periods. The early breeding season is *March 15 to July 31;* the late breeding season is *August 1 to September 30*. There is no general agreement as to how much spotted owls are negatively affected by noise disturbance. If they are susceptible to noise disturbance, it seems they would be more likely to be disturbed during the early breeding season when adults are producing and incubating eggs until active nesting ends at fledging. Findings by Wasser *et al.* (1997) support this conclusion. Once young owls become strong flyers, effects of noise disturbance are thought to be less. Delaney *et al.* (1997, 1999) found no difference in flush response to helicopters during breeding and non-breeding season. However, presumably, the impact of flushing would be greatest during early breeding season when the impact might cause the bird to abort or postpone feeding.

Table 15: Summary of Effects: Noise Disturbance on Northern Spotted Owl

Type of Disturbance	**Operating Period for Project Activities and Associated Effects Determinations Northern Spotted Owl**					
	No Effect		*May Affect, Not Likely to Adversely Affect*		*May Affect, Likely to Adversely Affect*	
	Date	Distance from owl circle	Date	Distance from owl circle	Date	Distance from owl circle
Blasts larger than 2 pounds	October 1 to March 14	Any	March 15 – July 31	> 1 mile	March 15 – July 31	< 1 mile
	August 1 to Sept 30	>1 mile	August 1 to Sept 30	< 1 mile		
Blasts less than or equal to 2 pounds	October 1 to March 14	any	March 15 – July 31	> 120 yards	March 15 – July 31	< 120 yards
	August 1 to Sept 30	>120 yards	August 1 to Sept 30	> 120 yards		
Heavy Equipment, motorized tools	October 1 to March 14	any	March 15 – July 31	>35 yards	March 15 – July 31	<35 yards
	August 1 to Sept 30	>35 yards	August 1 to Sept 30	<35 yards		
Chainsaws falling trees	October 1 to March 14	any	March 15 – July 31	>65 yards	March 15 – July 31	<65 yards
	August 1 to Sept 30	>65 yards	August 1 to Sept 30	<65 yards		
Chainsaws cutting downed wood	October 1 to March 14	any	March 15 – July 31	>65 yards	March 15 – July 31	<65 yards
	August 1 to Sept 30	>65 yards	August 1 to Sept 30	<65 yards		

There are 27 owl activity centers in Mount Rainier National Park and only 4 of the developed areas identified in the Hazard Tree Management Plan are within 0.7 mile of any of the sites. No standing hazard trees in these areas would be felled or topped using chain saws or blasting in the nesting season between March 15 and September 30. Downed trees (not part of this plan) and hanging trees would be removed during spring opening (March to June). This activity would occur between 2 hours after sunrise and 2 hours before sunset and would be greater than 65 yards from any northern spotted owl 0.7 mile activity circle. No northern spotted owl nests have been found in any of the developed areas in the Hazard Tree Management Plan. There is the potential to remove suitable northern spotted owl habitat, however, within these areas. The extent of the removal, however, would be small and outside the activity sites. In the 350 acres of

frontcountry sites there would be 236 trees larger than 20 inches DBH (less than one tree per acre). It is possible that about twice that many trees would be removed over the next ten years.

Several of the northern spotted owl activity sites are within 0.75 mile of roads. Therefore it is possible that trees will need to be removed that are within a 0.7 mile northern spotted owl activity circle. Most Hazard Tree Treatment would only take place between October 1 and March 14. However, it may be necessary to remove trees during spring road opening (March to June). It is estimated that five trees per year will be removed along roads during spring opening. Before any trees are removed the Wildlife Ecologist will be consulted. Downed trees along roads will be removed any time since the use of the required equipment will not likely generate noise levels significantly greater than or longer in duration than the ambient traffic noise. Currently there is only one hazard tree, which is along a road in the park, identified for treatment.

Table 16: Summary of Effects: Noise Disturbance on Marbled Murrelet

Type of Disturbance	**Operating Period for Project Activities and Associated Effects Determinations Marbled Murrelet**					
	No Effect		*May Affect, Not Likely to Adversely Affect*		*May Affect, Likely to Adversely Affect*	
	Date	Distance from suitable habitat	Date	Distance from Suitable Habitat	Date	Distance from Suitable Habitat
Blasts larger than 2 pounds	September 16 – March 30	any	April 1 – August 5	> 1 mile	April 1 – August 5	< 1 mile
	August 6 – September 15	> 1 mile	August 6 – September 15	< 1 mile	**---**	---
Blasts less than or equal to 2 pounds	September 16 – March 30	any	April 1 – August 5	> 120 yards	April 1 – August 5	< 120 yards
	August 6 – September 15	> 120 yards	August 6 – September 15	< 120 yards	**---**	**---**
Heavy Equipment, motorized tools	September 16 – March 30	Any	April 1 – August 5	>35 yards	April 1 – August 5	<35 yards
	August 6 – September 15	>35 yards	August 6 – September 15	<35 yards		
Chainsaws falling trees and cutting downed wood	September 16 – March 30	Any	April 1 – August 5	>45 yards	April 1 – August 5	<45 yards
	August 6 – September 15	>45 yards	August 6 – September 15	<45 yards		

Backcountry/Wilderness Camps

Eleven of the backcountry campsites are within one of the 27 owl activity centers in Mount Rainier National Park. Hazard trees in these eleven sites would only be removed between October 1 and March 14. It is possible that there would be removal of northern spotted owl nesting habitat in these campsites. The developed portion of these areas are very small, less than one acre each, so removal of hazard trees would be negligible to minor on the overall habitat.

Marbled Murrelet

Direct effects to marbled murrelets could result from noise and disturbance impacts and loss of habitat by the removal of hazard trees.

Timing**:** Similar to the northern spotted owl, for impact analysis purposes, the breeding season for marbled murrelets is divided into an early season, *April 1 through August 5*, and late season, *August 6 through September 15*. The birds are thought to be the most vulnerable to noise disturbance during the early breeding season when adults are producing and incubating the eggs. Even within the early breeding season, there is a timeframe when the species may be more susceptible to reproductive loss. Startling the adult from the nest while it is incubating either an egg or chick could result in loss of the egg or chick. Once the chick is left alone for most of the day, the risk of noise disturbance resulting in the loss of the chick may be substantially reduced (W. Ritchie, Pers. comm., T. Hamer 2000, Pers. comm.) unless the noise causes adults to abort feeding trips to the nest.

Throughout the entire breeding season, adult murrelet activity near the nest site is highest within 2 hours of sunrise and sunset. Adult flights into/out of the nest, however, have been documented at all hours of the day.

Most of the hazard trees to be removed in the park are not suitable for marbled murrelet use. Only about 20 percent of identified hazard trees are live conifers above 20 inches DBH. There are only three developed areas in the park with suitable marbled murrelet habitat, the Carbon River Entrance, Ipsut Creek Campground (marginal habitat) and Cougar Rock Campground (marginal habitat). The habitat in the campgrounds is considered marginal habitat because there are few trees with suitable nest platforms. In addition there are high ambient noise levels in the campgrounds and the areas are active campgrounds and therefore have frequent corvid presence. The Carbon River Valley has thousands of acres of prime marbled murrelet nesting habitat so the likelihood of marbled murrelet nesting in Ipsut Creek Campground is very low. The wildlife ecologist will evaluate every hazard tree greater than 20 inches DBH in these three areas and determine if they contain suitable nest platforms. No habitat trees would be removed from these areas between April 1 and September 15. If hazard trees are present after the winter and cannot be treated before April 1, the site will be closed for the summer and the tree treated after September 15. There may be downed trees that need to be removed from the campgrounds between April 1 and September 15. If this occurs then this will be done between two hours after sunrise and two hours before sunset. Over the next ten years it is estimated that a maximum of 50 downed trees would need to be removed between April 1 and September 15.

Site Specific Impacts to Northern Spotted Owl and Marbled Murrelet

Below is a summary of the impacts of the proposed Hazard Tree Management Plan at each of the developed areas and backcountry/wilderness camps in Mount Rainier National Park that have recently been surveyed for hazard trees. Unless otherwise specified below, hazard tree removal identified in this plan would only take place between October 1 and March 14 each year**.** Numbers of hazard trees analyzed in the Biological Assessment and Biological Opinion and discussed below were based on data available in 2005. Delays in releasing this EA required that some treatment occur to insure the safety of visitors and park employees. While Tables 1 and 6 were updated for these treatments and additional hazard trees identified, the discussion below and summarized in Tables 17 and 18 do not reflect these changes.

Mowich Lake Campground (Elevation 4,930 feet):

There are six identified hazard trees over 20 inches DBH and three of these are likely to be removed in the next two years. Mowich Lake Campground is well above suitable marbled murrelet nesting habitat. It is also above suitable northern spotted owl nesting habitat and none of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determinations for any removal of hazard trees from the Mowich Lake Campground any time of the year are “no effect” for both northern spotted owls and marbled murrelets.

Tahoma Woods (Elevation 1,400 feet):

There is one identified hazard trees over 20 inches DBH and neither is likely to be removed in the next two years. Neither of the identified trees is suitable marbled murrelet nesting habitat and there is no marbled murrelet habitat found within the Tahoma Woods area. None of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determinations for any

removal of hazard trees from the Tahoma Woods any time of the year would be “may affect, not likely to adversely affect” for northern spotted owls and “no effect” for marbled murrelets.

Nisqually Entrance (Elevation 2,000 feet):
There is one identified hazard tree over 20 inches DBH which is not likely to be removed in the next two years. The identified tree also is not suitable marbled murrelet nesting habitat. There is no marbled murrelet habitat found within 45 yards of the Nisqually Entrance, however habitat is found within 0.25 mile of the area. None of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determination for any removal of hazard trees from the Nisqually Entrance area any time of the year is “may affect, not likely to adversely affect” for both northern spotted owls and marbled murrelets.

Sunshine Point Campground (Elevation 2,100 feet):
There are three identified hazard trees over 20 inches DBH, none of which are likely to be removed in the next two years. None of the identified trees are suitable marbled murrelet nesting habitat. There is no marbled murrelet habitat found within 45 yards of the Sunshine Point Campground, however habitat is found within 0.25 mile of the area. The area is not within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determination for any removal of hazard trees from the Sunshine Point Campground any time of the year is “may affect, not likely to adversely affect” for both northern spotted owls and marbled murrelets.

Kautz Creek Picnic Area (Elevation 2,100 feet):
There are two identified hazard trees over 20 inches DBH and both are likely to be removed in the next two years. This is an area that was affected by a large flood in the 1940’s and there is no suitable marbled murrelet nesting habitat within 0.25 mile, however habitat is found within 0.50 mile of the area. There is suitable northern spotted owl nesting habitat approximately0.25 mile from the area but none of the area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determination for any removal of hazard trees from the Kautz Creek picnic area any time of the year is “may affect, not likely to adversely affect” for both northern spotted owls and marbled murrelets.

Longmire Administration Area (Elevation 2,780 feet):
There are 29 identified hazard trees over 20 inches DBH and 11 of are likely to be removed in the next two years. None of the identified trees is suitable marbled murrelet nesting habitat. There is no marbled murrelet habitat found within 45 yards of the Longmire Administration area, however habitat is found within 0.25 mile of the area. None of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determination for any removal of hazard trees from the Longmire Administration area any time of the year is “may affect, not likely to adversely affect” both northern spotted owls and marbled murrelets.

Longmire Campground (Elevation 2,780 feet):
There are 13 identified hazard trees over 20 inches DBH, six of which are likely to be removed in the next two years. None of the identified trees is suitable marbled murrelet nesting habitat. There is no marbled murrelet habitat found within 45 yards of the Longmire Campground, however habitat is found within 0.25 mile of the area. None of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determination for any removal of hazard trees from the Longmire Campground any time of the year is “may affect, not likely to adversely affect” both northern spotted owls and marbled murrelets.

Cougar Rock Campground: (Elevation 3,220 feet):
There are 80 identified hazard trees over 20 inches DBH, of which 20 are likely to be removed in the next two years. None of the 20 identified trees is suitable marbled murrelet nesting habitat. There is marbled murrelet habitat found within 45 yards within a portion of the Cougar Rock Campground. None of the Campground is within 65 yards of any of the 0.7 mile owl activity centers. To avoid possible noise disturbance to marbled murrelets no trees will be removed within 45 yards of suitable marbled murrelet habitat between April 1 and September 15. The maximum number of hazard trees that are suitable marbled murrelet habitat to be removed in the

next ten years is 40. To mitigate the removal of marbled murrelet habitat campsites would be closed and new ones created in areas of the campground that do not contain murrelet habitat. Every attempt would be made to avoid removing marbled murrelet habitat trees. If suitable marbled murrelet habitat does need to be removed then the determination of effect would be "may affect, likely to adversely affect." Similarly, the determination for any removal of hazard trees from the Cougar Rock Campground would be "may affect, not likely to adversely affect."

Cougar Rock Picnic Area: (Elevation 3,220 feet):
There are 49 identified hazard trees over 20 inches DBH and 14 of these are likely to be removed in the next two years. The maximum number of hazard trees that are suitable marbled murrelet habitat to be removed in the next ten years is 20. To mitigate the removal of marbled murrelet habitat, affected picnic sites would be closed and new ones created in areas of the picnic that do not contain murrelet habitat. Every attempt would be made to avoid removing marbled murrelet habitat trees. If suitable marbled murrelet habitat does need to be removed, the determination of effect would be "may affect, likely to adversely affect." Similarly, the determination of effect for any removal of hazard trees from the Cougar Rock Picnic Area for northern spotted owls would be "may affect, not likely to adversely affect."

Narada Falls (Elevation 4,800 feet):
There are three identified hazard trees over 20 inches DBH, none of which is likely to be removed in the next two years. This area is well above suitable marbled murrelet nesting habitat. There is suitable northern spotted owl nesting habitat approximately 0.25 mile from the area but none is within 65 yards of any of the 0.7 mile owl activity centers. Any removal of hazard trees from the Narada Falls would be done between October 1 and March 14. Therefore, the determination for both northern spotted owls and marbled murrelets would be "may affect, not likely to adversely affect."

Paradise and Paradise Picnic Area (Elevation 5,420 feet):
There are 14 identified hazard trees over 20 inches DBH, five of which are likely to be removed in the next two years. Paradise is well above suitable marbled murrelet nesting habitat. It is also above suitable northern spotted owl nesting habitat. Therefore, the determinations for any removal of hazard trees from the Paradise area any time of the year would have "no effect" on either northern spotted owls or marbled murrelets.

Box Canyon (Elevation 3,000 feet):
There are currently two identified hazard trees over 20 inches DBH at Box Canyon; however hazards may be identified in the future. There is no marbled murrelet habitat found in the Box Canyon area. None of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determinations for any removal of hazard trees from the Box Canyon any time of the year are "may affect, not likely to adversely affect" for northern spotted owls and "no effect" for marbled murrelets.

Grove of the Patriarchs: (Elevation 2,200 feet):
There are three identified hazard trees over 20 inches DBH at Grove of the Patriarchs; however hazards may be identified in the future. It is estimated that no more than five trees over 20 inches DBH would be removed in the next ten years. Although nesting structure exists, there is no marbled murrelet habitat found within the Grove of the Patriarchs (too far from saltwater). This area is one of four areas in this plan *within* the 0.7 mile owl activity centers but well beyond a 65 yard buffer of 100 acre core area (0.22 mile radius). Any removal of hazard trees from the Grove of the Patriarchs Developed Area would be done between October 1 and March 14. Therefore, the determinations of effect would be "may affect, not likely to adversely affect" for northern spotted owls and "no effect" on marbled murrelets.

Stevens Canyon Entrance: (Elevation 2,200 feet):
There are no identified hazard trees over 20 inches DBH at Stevens Canyon Entrance; however hazards may be identified in the future. Although nesting structure exists in this watershed, there is no marbled murrelet habitat found within45 yards of the Stevens Canyon Entrance. This area

is one of four areas in this plan *within* the 0.7 mile owl activity centers but well beyond a 65 yard buffer of 100 acre core area (0.22 mi radius). Any removal of hazard trees from the Stevens Canyon developed area would be done between October 1 and March 14. Therefore the determination of effect is "may affect, not likely to adversely affect" for northern spotted owls and "no effect" for marbled murrelets.

Ohanapecosh Campground (Elevation 1,920 feet):
There are 409 identified hazard trees over 20 inches DBH and 118 of these are likely to be removed in the next two years. It is estimated that afterwards no more than five trees over 20 inches DBH would be removed in the next ten years. None of the identified trees is suitable marbled murrelet nesting habitat and there is no marbled murrelet habitat found within the Ohanapecosh Campground. This area is one of four areas in this plan *within* the 0.7 mile owl activity centers but well beyond a 65 yard buffer of 100 acre core area (0.22 mi radius). Any removal of hazard trees from the Ohanapecosh Campground area would be done between October 1 and March 14. Therefore, the determination of effect is "may affect, not likely to adversely affect" for northern spotted owls and "no effect" for marbled murrelets.

Ohanapecosh Administrative Area (Elevation 1,920 feet):
There are five identified hazard trees over 20 inches DBH, three of which are likely to be removed in the next two years. It is estimated that no more than five additional trees over 20 inches DBH would be removed in the next ten years. None of the identified trees is suitable marbled murrelet nesting habitat and there is no marbled murrelet habitat found within the Ohanapecosh Administrative Area. This area is one of four areas in this plan *within* the 0.7 mile owl activity centers but well beyond a 65 yard buffer of 100 acre core area (.22mi radius). Any removal of hazard trees from the Ohanapecosh Administrative Area would be done between October 1 and March 14. Therefore the determination of effect would be "may affect, not likely to adversely affect" for northern spotted owls and "no effect" for marbled murrelets.

White River Entrance (Elevation 3,600 feet):
There are 18 identified hazard trees over 20 inches DBH, with 15 of these likely to be removed in the next two years. None of the identified trees is suitable marbled murrelet nesting habitat and there is no marbled murrelet habitat found within the White River Entrance, however habitat is found within 0.25 mile of the area. None of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determination for any removal of hazard trees from the White River Entrance any time of the year is "may affect, not likely to adversely affect" for both northern spotted owls and marbled murrelets.

White River Campground (Elevation 4,100 feet):
There are 86 identified hazard trees over 20 inches DBH and ten of these are scheduled to be removed in the next two years. None of the identified trees are suitable marbled murrelet nesting habitat. There is no marbled murrelet habitat found within 45 yards of the White River Campground and is well above suitable habitat. None of this area is within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determinations for any removal of hazard trees from the White River Campground any time of the year "may affect, not likely to adversely affect" northern spotted owl and have "no effect" on marbled murrelet.

Sunrise (Elevation 6,200 feet):
There is one identified hazard tree over 20 inches DBH which is likely to be removed in the next two years. Sunrise is well above suitable marbled murrelet and northern spotted owl nesting habitat. Therefore, the determination for any removal of hazard trees from the Sunrise area any time of the year would be "no effect" for both northern spotted owls and marbled murrelets.

Park Roads:
There are ten identified hazard tree over 20 inches DBH along park roads, with one tree likely to be removed in the next two years. There is suitable marbled murrelet along some of the roads and a number of roads are within one of the 0.7 mile northern spotted owl activity center circles. As a result, removal of hazard trees found along roads would occur only between October 1 and

March 14. It is possible, however, that up to five trees a year may need to be removed along roads during spring opening (March to June). It is estimated that no more than 100 trees over 20 inches DBH will be removed in the next ten years. Therefore, the determinations for hazard tree removal on roads are "may affect, not likely to adversely affect" for northern spotted owls and "may affect, likely to adversely affect" for marbled murrelets.

Carbon River Entrance: (Elevation 1,780 feet) *(see previous discussion regarding the status of the Carbon River Access Plan EA):*
There is one identified hazard tree over 20 inches DBH at Carbon River Entrance; however more hazards may be identified in the future. It is estimated that no more than 25 trees over 20 inches DBH would be removed in the next ten years. There is occupied marbled murrelet habitat found within 45 yards of the Carbon River Entrance; .the entrance area is not within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determinations for removal of any hazard tree from the Carbon River Entrance any time of the year is "may affect, not likely to adversely affect" for northern spotted owls and "may affect, likely to adversely affect" for marbled murrelets. To mitigate the effects on marbled murrelets, trees would only be removed between September 16 and March 31.

Ipsut Creek Campground: (Elevation 2,360 feet) *(see previous discussion regarding the status of the Carbon River EA):*
There are 46 identified hazard trees over 20 inches DBH and 19 of these are may be removed in the next two years. Twelve of the trees are suitable marbled murrelet nesting habitat. These trees were determined to be suitable nesting habitat through direct observation by a trained marbled murrelet biologist. An additional 38 trees may require treatment in the next ten years that are considered suitable marbled murrelet habitat. Therefore the greatest number of marbled murrelet nesting habitat trees to be removed in the next ten years is 50. Occupied marbled murrelet habitat can be found within 45 yards of the Ipsut Creek Campground, and the campground area is not within 65 yards of any of the 0.7 mile owl activity centers. Therefore, the determinations for removal of hazard any trees from the Ipsut Creek Campground any time of the year is "may affect, not likely to adversely affect" for northern spotted owls, and "may affect, likely to adversely affect" for marbled murrelets. To mitigate the effects on marbled murrelet, trees will only be removed between September 16 and March 31. In addition, if chainsaws or heavy equipment would be used to remove downed trees in the campground between April 1 and September 15 this activity will occur 2 hours after sunrise and 2 hours before sunset.

Wilderness Camps and Historic Structures

There are 37 wilderness camps in Mount Rainier National Park that will be surveyed for hazard trees. Only two (Carbon River and South Mowich River) contain suitable marbled murrelet habitat. Eleven have suitable northern spotted owl habitat (Carbon River, Deer Creek, Fire Creek, Lake George, Nickel Creek, North Puyallup, Olallie Creek, Paradise River, Pyramid Creek, South Mowich River and South Puyallup River) and four camps are within the 0.7 mile circle of a northern spotted owl activity center (North Puyallup, Paradise River, Pyramid Creek, and South Mowich River). **Removal of any trees at the eleven camps located within suitable northern spotted owl habitat would occur between October 1 and March 14**. Hazard tree surveys have only been conducted at four camps so far and only two of these were conducted in areas with northern spotted owl habitat (Lake George and Paradise River). Table 18 contains estimates of the numbers of hazard trees that would need to be removed over the next ten years. It is estimated that no more than 110 trees over 20 inches DBH will be removed from the camps in the next ten years. It is also estimated that a maximum of 54 hazard trees would be removed within a 0.7 mile owl activity center over the next ten years. For marbled murrelets, it is estimated that no more than 22 marbled murrelet habitat trees would be removed over the next ten years.

Lake George Camp (Elevation 4,320 feet):
Seventeen hazard trees over 20 inches DBH that would likely be removed in the next two years have been identified. Lake George is well above suitable marbled murrelet nesting habitat. While it is located in suitable northern spotted owl nesting habitat, it is not within a 0.7 mile owl activity center. Therefore, the determinations for any removal of hazard trees from the Lake

George between October 1 and March 14 are “may affect, not likely to adversely affect” for northern spotted owls and “no effect” on marbled murrelets.

Paradise River Camp (Elevation 3,800 feet):
There are six identified hazard trees over 20 inches DBH, of which four are likely to be removed in the next two years. Paradise River is at 3,800 feet and is above suitable marbled murrelet nesting habitat. It is, however, located in suitable northern spotted owl nesting habitat and is within a 0.7 mile owl activity center. Therefore, the determination for any removal of hazard trees from the Paradise River between October 1 and March 14 is “may affect, not likely to adversely affect” for northern spotted owls and “no effect” for marbled murrelets.

Lake James Camp (Elevation 4,600 feet):
There are 14 identified hazard trees over 20 inches DBH, seven of which are likely to be removed in the next two years Lake James is located above suitable marbled murrelet nesting habitat and suitable northern spotted owl nesting habitat. Therefore, the determination for any removal of hazard trees from the Lake James Camp any time of the year is “no effect” for both northern spotted owls and marbled murrelets.

Mystic Lake Camp (Elevation 5,500 feet):
There are 12 identified hazard trees over 20 inches DBH, of which seven are likely to be removed in the next two years. Mystic Lake is above suitable marbled murrelet and northern spotted owl nesting habitat. Therefore, the determination for any removal of hazard trees from Mystic Lake any time of the year is “no effect” for both northern spotted owls and marbled murrelets.

Pyramid Creek Camp (Elevation 3,765 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is four. This site is above suitable marbled murrelet nesting habitat. It is in suitable northern spotted owl nesting habitat and within a 0.7 mile owl activity center. Therefore, the determinations for any removal of hazard trees from Pyramid Creek between October 1 and March 14 would be “may affect, not likely to adversely affect” for northern spotted owls and “no effect” for marbled murrelets.

South Puyallup Camp (Elevation 4,000 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is ten. This site is above suitable marbled murrelet nesting habitat. It is in suitable northern spotted owl nesting habitat but not within a 0.7 mile owl activity center. Therefore, the determination for any removal of hazard trees from South Puyallup between October 1 and March 14 is “may affect, not likely to adversely affect” for both northern spotted owls and marbled murrelets.

North Puyallup Camp (Elevation 3,750 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is four. This site is above suitable marbled murrelet nesting habitat, but there is murrelet habitat within 0.50 mile of the site. It is in suitable northern spotted owl nesting habitat and within a 0.7 mile owl activity center. Therefore, the determination for any removal of hazard trees from North Puyallup between October 1 and March 14 is “may affect, not likely to adversely affect” for both northern spotted owls and marbled murrelets.

South Mowich Camp (Elevation 2,605 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is 20. There is occupied marbled murrelet habitat found within 45 yards of the South Mowich Camp. It is in suitable northern spotted owl nesting habitat and within a 0.7 mile owl activity center. Therefore, the determinations for any removal of hazard trees between October 1 and March 14 would be “may affect, not likely to adversely affect” for northern spotted owls and “may affect, likely to adversely affect” for marbled murrelets.

Carbon River Camp (Elevation 3,195 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is four. There is occupied marbled murrelet habitat found within 45 yards of the Carbon River. It is in suitable northern spotted owl nesting habitat but not within a 0.7 mile owl activity center. Therefore, the determinations for any removal of hazard trees between September 16 and March 31 are "may affect, not likely to adversely affect" for northern spotted owls and "may affect, likely to adversely affect" for marbled murrelets.

Fire Creek Camp (4,300 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is eight. This site is above suitable marbled murrelet nesting habitat. It is in suitable northern spotted owl nesting habitat but not within a 0.7 mile owl activity center. Therefore, the determinations for any removal of hazard trees between October 1 and March 14 are "may affect, not likely to adversely affect" for northern spotted owls and "no effect" for marbled murrelets.

Deer Creek Camp (2,950 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is four. This site does not have suitable marbled murrelet nesting habitat. It is in suitable northern spotted owl nesting habitat but not within a 0.7 mile owl activity center. Therefore, the determinations for any removal of hazard trees between October 1 and March 14 are "may affect, not likely to adversely affect" for northern spotted owls and "no effect" for marbled murrelets.

Olallie Creek Camp (3,800 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is six. This site is above suitable marbled murrelet nesting habitat. It is in suitable northern spotted owl nesting habitat but not within a 0.7 mile owl activity center. Therefore, the determinations for any removal of hazard trees between October 1 and March 14 are "may affect, not likely to adversely affect" for northern spotted owls and "no effect" for marbled murrelets.

Nickel Creek Camp (3,385 feet):
This site has not been surveyed for hazard trees. It is estimated that the maximum number of hazard trees over 20 inches DBH that could be removed over the next ten years is eight. There is no suitable marbled murrelet nesting habitat within 45 yards of the site but there is habitat within 0.25 mile of this site. It is in suitable northern spotted owl nesting habitat but not within a 0.7 mile owl activity center. Therefore, the determination for any removal of hazard trees between October 1 and March 14 is "may affect, not likely to adversely affect" for both northern spotted owls and marbled murrelets.

Table 17: Summary of Hazard Trees with Defects in Frontcountry and Wilderness

Park Area	Number of Acres Potentially Affected	Number of Identified Hazard Trees	Number of Identified Hazard Trees over 20 " DBH	Number of Trees over 20" DBH rated 7 or 8	Within 0.7 mile Spotted Owl Activity Circle	Marbled Murrelet Habitat within 45 yards	Dates available for treating Hazard Trees
Mowich Lake Campground	4.6	6	6	3	No	None	Year-round
Tahoma Woods	30	11	4	1	No	None	October 1 to March 14
Nisqually Entrance	8.9	3	1	0	No	None	Year-round
Sunshine Point Campground	9.8	25	3	0	No	None	Year-round
Kautz Creek	5	3	2	2	No	None	Year-round
West Side Roads		2	2	0	Yes	Yes	October 1 to March 14
Longmire	19.4	76	29	13	No	None	Year-round
Longmire Campground	36.0	32	13	6	No	None	Year-round
Cougar Rock Campground	48.2	203	80	20	No	Yes	September16 to March 31
Cougar Rock Picnic Area	7	85	49	14	No	Yes	September16 to March 31
Narada Falls	2	4	3	0	No	None	October 1 to March 14
Paradise	2.4	11	10	5	No	None	Year-round
Paradise Picnic Area	2.1	11	4	0	No	None	Year-round
Box Canyon	5	9	2	0	No	None	Year-round
Grove of Patriarchs	5.2	3	3	1	Yes	None	October 1 to March 14
Stevens Canyon Entrance	7.5	0	0	0	Yes	None	October 1 to March 14
East Side Roads		8	8	1	Yes	None	October 1 to March 14
Ohanapecosh Campground	67.7	694	409	118	Yes	None	October 1 to March 14
Ohanapecosh Administrative Area	16.9	10	5	3	Yes	None	October 1 to March 14
White River Entrance	13.4	46	18	15	No	None	Year-round
White River Campground	32.0	156	91	10	No	None	Year-round
Sunrise	24.2	2	1	1	No	None	Year-round
Carbon River Entrance	10.1	2	1	0	No	Occupied	September16 to March 31
Ipsut Creek Campground	8.8	58	46	19	No	Occupied	September16 to March 14
WILDERNESS							
Paradise River	1.0	7	6	4	Yes	None	October 1 to March 14
Lake George	1.0	33	26	17	Yes	None	October 1 to March 14
Lake James	1.0	17	14	7	No	None	Year-round
Mystic Lake	1.0	48	12	7	No	None	Year-round
Total	**370.2**	**1565**	**848**	**271**			

Table 18: Summary of Maximum Number of Hazard Trees Greater Than 20 inches DBH Likely to be Removed in Frontcountry and Backcountry/Wilderness that contain either marbled murrelet or northern spotted owl habitat

Park Area	Number of Acres Potentially Affected	Number of Identified Hazard Trees over 20 " DBH	Greatest Number of Trees over 20" DBH to be removed	Number of trees within 0.7 mile Spotted Owl Activity Circle	Number of Marbled Murrelet Habitat Trees to be removed	Dates available for treating Hazard Trees
West Side Roads		2	50	50	50	October 1 to March 14
Cougar Rock Campground	48.2	80	80	0	40	September16 to March 31
Cougar Rock Picnic Area	7	49	50	0	20	September16 to March 31
Grove of Patriarchs	5.2	3	5	5	0	October 1 to March 14
Stevens Canyon Entrance	7.5	0	5	5	0	October 1 to March 14
East Side Roads		8	50	50	0	October 1 to March 14
Ohanapecosh Campground	67.7	409	410	410	0	October 1 to March 14
Ohanapecosh Administrative Area	16.9	5	5	5	0	October 1 to March 14
Carbon River Entrance	10.1	1	25	0	25	September16 to March 31
Ipsut Creek Campground	8.8	46	50	0	50	September16 to March 31
WILDERNESS						
Paradise River	1.0	6	6	6	0	October 1 to March 14
Pyramid Creek*	1.0	Not Surveyed	4	4	0	October 1 to March 14
Lake George	1.0	26	26	0	0	October 1 to March 14
South Puyallup*	1.0	Not Surveyed	10	10	0	October 1 to March 14
North Puyallup*	1.0	Not Surveyed	4	4	0	October 1 to March 14
South Mowich*	1.0	Not Surveyed	20	20	20	October 1 to March 14
Carbon River*	1.0	Not Surveyed	4	0	2	September16 to March 31
Fire Creek*	1.0	Not Surveyed	8	0	0	October 1 to March 14
Deer Creek*	1.0	Not Surveyed	4	4	0	October 1 to March 14
Olallie Creek*	1.0	Not Surveyed	6	0	0	October 1 to March 14
Nickel Creek*	1.0	Not Surveyed	8	0	0	October 1 to March 14
Total	**182.4**	**635**	**830**	**573**	**207**	

*Carbon River, Deer Creek, Fire Creek, Nickel Creek, North Puyallup, Olallie Creek, Pyramid Creek, South Mowich River and South Puyallup have not been surveyed for hazard trees. The numbers presented are estimates based on surveys from similar camps.

Park Roads

There is one identified hazard tree over 20 inches DBH along park roads (Nisqually to Paradise Road) that is scheduled to be removed in the next two years. There is no suitable marbled murrelet in the area of this tree but it is within one of the 0.7 mile northern spotted owl circles. Removal of this tree and any other hazard tree found along roads would occur between October 1 and March 15. Therefore the determination for removal of trees along roads is "may affect, not likely to adversely affect" for both northern spotted owls and marbled murrelets.

Interdependent and Interrelated Effects: The presence of humans in campgrounds has the potential to increase corvid activity, and consequently lead to increased nest predation, due to improper storage of food and waste. However this is not anticipated to occur in any large degree. As per NPS policy, all food and garbage will be secured in such a way that they are not available to wildlife, and will be removed from the site during the decamping process. These provisions are principally in place due to bear management guidelines, but they also serve to prevent food habituation in other wildlife species.

Conclusion: Summary of Effects on Marbled Murrelet and Northern Spotted Owl

Under the proposed Hazard Tree Management Plan, Mount Rainier National Park would remove up to 236 trees over 20 inches DBH in 366 acres of frontcountry sites and 35 trees at four backcountry campsites in the next two years. This would equal about three acres of trees spread out over all the developed sites and backcountry camps. Only 12 of the 271 hazard trees to be treated in the next two years are suitable marbled murrelet habitat (five percent of trees). Over the next ten years there could be the removal of an additional 205 suitable marbled murrelet trees. In addition, the plan would also result in the removal of about 579 suitable northern spotted owl nesting trees over the next ten years (Table 18). Therefore the effect determination for these two species is "may affect, not likely to adversely affect" for northern spotted owls and "may affect, likely to adversely affect" for marbled murrelets.

Impacts to Archeology

Impacts of Alternative 1: There would be no effect on known archeological resources. Because however, surveys have not been conducted for archeological resources in all developed areas and because survey methodology has changed, there is a possibility for previously unknown archeological resources to be discovered in the actions associated with survey and treatment of hazardous trees. Therefore, as hazard trees are identified in areas without survey, these would be surveyed, prior to any action being taken. The likelihood of impacting archeological resources, however would be more likely to occur with natural tree fall, where trees may be uprooted, resulting in previously unexposed soil area to be seen. Most hazard tree removal, however, would occur in areas previously disturbed by development, including by structures, campgrounds, roads, trails or trailside camps. As a result, any effects associated with proposed hazard tree removal would be expected to be negligible to minor and would be further restricted by immediate reporting of potential archeological finds. If prehistoric or historic archeological resources were discovered during any portion of a proposed action, work in the area associated with the find would cease until evaluated by the park archeologist or designated representative. Every effort would be made to avoid further disturbance to the site and at a minimum, additional consultation with the Washington State Office of Archeology and Historic Preservation would occur to determine the significance and recommended disposition of the find. As appropriate, other consultation, such as under NAGPRA, would also occur.

Impacts of Alternative 2: Potential effects on archeological resources would be the same as Alternative 1.

Cumulative Impacts: Archeological impacts resulting from past development have the potential to be minor to moderate. Most development in the park predated requirements for archeological survey and testing. Therefore, as new opportunities to survey areas previously impacted by development arise, efforts are made to survey and/or test for archeological resources. Because

there would be minimal potential for discovering archeological resources in highly impacted park developed areas, the Alternatives described herein would not contribute to cumulative effects on archeological resources.

Conclusion: There would be no effect on and no impairment of known archeological resources or their values as a result of Alternatives 1 or 2.

Impacts to Ethnography

Impacts of Alternatives 1 and 2: There would be no effect on or impairment of any known ethnographic resources. Neither alternative proposes use where use is not already occurring, nor would either alternative change current Native American use of existing areas. If areas of use were later identified in the vicinity of proposed hazard tree treatments, consultation with the affected Native American tribe(s) and, as appropriate, the Washington State Office of Archeology and Historic Preservation would occur to determine how to proceed.

Impacts to Historic Structures/Cultural Landscapes

Mount Rainier National Historic Landmark District

Historic Structures/Cultural Landscapes Impacts of Alternative 1: Hazard tree treatments in this Alternative have the potential to affect six historic districts, five National Historic Landmark buildings, one eligible Mission 66 district, and the broadly defined cultural landscapes of the Mount Rainier National Historic Landmark District.

Initially, the loss of approximately 450 trees, from a variety of developed areas, following the approval of this plan, however, would have no effect on historic structures due to mitigation measures in the felling or other treatment options that would avoid effects and because the removal of the trees would have a long-term beneficial effect on the preservation of the affected historic structure or "target." In addition, the removal of hazard trees near historic structures would continue to be undertaken with care (removing trees only when necessary and identifying the direction of the felling operation) to avoid effects on the structures themselves while minimizing the loss of trees associated with the historic landscape. While most trees would be left in place, following treatment, some would continue to be used in the restoration or rehabilitation of historic structures, resulting in a negligible to moderate beneficial effect on historic resources. Tree treatments would also result in a negligible incremental loss of original landscaping associated with the historic period of development that would be offset by replanting. The net effect would be negligible with respect to the vegetation, building and structure characteristics of the Mount Rainier NHLD, dependent on the magnitude of the treatment or removal in the vicinity of historic structures, including buildings, roads and trails. There would be no effect on the NHLD characteristics of spatial organization, circulation or topography.

Under this Alternative, frontcountry and backcountry/wilderness hazard tree surveys near historic buildings would be conducted every three years, with treatment following soon after documentation. (In practice, however, this stated frequency of surveys has not occurred.) Even so, the surveys near historic structures in wilderness would aid in the preservation of those structures by early detection of defects and retention of cultural resources values. Surveys along park roads, which are also historic structures and which contain historic culvert headwalls, bridges and other similar structures, are not planned except as reported. Although annual monitoring would not occur, the frequency of complete surveys around buildings would likely result in the detection of most defects with known potential to become hazards. In wilderness and along roads, where only minimal attention would occur, occasionally trees with no obvious defects would fall in winter and could affect buildings or structures. Upon occurrence, an assessment of effects would be conducted and the structure repaired, if possible, in adherence to the Secretary of Interior's Standards.

Historic Structures/Cultural Landscapes Impacts of Alternative 2: Impacts associated with this Alternative would be similar to Alternative 1, however, surveys near backcountry/wilderness structures would be less frequent (every five instead of every three years), while surveys near

frontcountry structures would be coupled with annual monitoring. (*Note*: In practice, the surveys called for by Alternative 1 have not been occurring at the stated, more frequent rate.) In addition, there would be drive-by monitoring and photo-documentation analysis of tree hazards along park roads. Coupled with more systematic surveys, better analysis of defects and other features, this Alternative would result in a potential for somewhat better protection of historic structures by increasing the frequency with which defects would be detected where most historic structures are located (frontcountry). This alternative also calls for a specific hazard tree management coordinator position. Concurrently, while decreased, the frequency of surveys near backcountry/wilderness structures would be unlikely to result in adverse effects to structures, because tree defects near these structures would likely continue to be either detected by the less frequent monitoring or reported by staff using these buildings during the primary visitor use season.

Cumulative Impacts: Over time, the prevalence of standing trees in the vicinity of historic structures has decreased, with trees used for the construction of the structures themselves and for support structures, downed logs used for firewood and, as needed, standing and downed trees used for rehabilitation of the structures, as well as some trees previously removed as hazards that targeted these structures. Although the historic practice of construction and repair of park structures used park materials native to the sites, the current practice is not to use downed material (native to the site) but to import logs from outside the park or to use wood from trees that fall alongside roads in winter to repair historic structures. The removal of individual hazard trees from the vicinity of structures over time has incrementally added to these impacts associated with construction. Where possible, the practice is now to restore the historic landscape characteristics that were present during the period of significance for the Mount Rainier National Historic Landmark District and or for other important cultural resources that might be designated.

In addition, periodically, throughout the history of the park, trees have fallen on structures, including on historic structures. Because of more systematic monitoring this would be less likely to occur under Alternative 2. Occasionally, however, apparently healthy trees do fail.

To mitigate the impacts of past and future hazard tree removal under either alternative, efforts would be made to assess restoration needs associated with cultural landscapes in the park. As appropriate, often directed by cultural landscape inventory and analysis and documented in a cultural landscape report, replanting to mimic the historic landscape would occur.

Conclusion: Actions associated with either Alternative 1 or Alternative 2 would result in no adverse effect on historic structures or cultural landscapes. As a result, there would be no impairment of these resources or the values for which they have been protected in Mount Rainier National Park.

Impacts to Visitor Experience

Visitor Experience Impacts of Alternative 1: Removing trees with high ratings (5-7) in this Alternative would effectively eliminate known tree hazards resulting in a minor to major beneficial effect. Despite this, unknown or unsurveyed hazards would still be present, thereby not entirely eliminating the risks of recreating in a natural area. Adverse weather conditions, such as high winds, fires and other environmental conditions could exacerbate this risk. Therefore while known, surveyed tree hazards would be periodically removed, the survey and elimination of these hazards would not result in a risk-free environment. Sometimes healthy trees fail and fall. This could result in a localized negligible to moderate risk for park visitors depending on where, how long and during what conditions they stayed in the park.

There would be a negligible to moderate impact on visitor access during treatment operations. While identification of hazard trees would take place during the snow-free season (primarily summer), removal of hazard trees would take place primarily in fall to avoid potential impacts on visitor access (closure of roads, campsites or other facilities during tree felling or treatment operations) and wildlife, including special status species. Imminent hazards (such as a tree rated 8, with multiple, severe defects – perhaps a severe lean or more than 50 percent of its root mass

lifting, or extensive rot, etc. and likelihood of hitting an immoveable target) would be treated as soon as practicable or the site(s) temporarily closed to diminish the hazards. This and other longer term closures could result in a negligible to moderate effects on visitor use, depending on how they affected an individual's choice of destination(s). For longer term closures, this effect would diminish over time. For instance, the closure of five sites at Cougar Rock Campground in 1998 immediately and since then has resulted in slightly fewer campsites being available to visitors until the large number of affected trees fall. This is considered a negligible to minor impact in this 185 site campground, which fills to capacity on weekends and some weekdays in summer. Temporary, short-term closures during tree felling operations, would most likely not occur during the primary visitor use season, but could be used to mitigate imminent hazards, thereby causing potential disruption to a small number of visitors who might be affected by the closure(s). As noted in *Affected Environment*, only a small percentage of park visitors stay overnight in the park and of those, fewer choose Cougar Rock Campground.

Negligible to moderate impacts to the aesthetic characteristics of park forests used by visitors would also result from the treatment, particularly removal, of hazard trees. Among these could range from the loss of individual trees in a camp or picnic site, to the loss of most trees in a site. Impacts to these values could also include loss of old growth characteristics over time, including deep forest shade and/or the appearance of closed canopies. Over time campgrounds, picnic areas and other developed sites could appear more open.

The appreciation of these aesthetic and other resource values appears to vary widely among park visitors based on comments on other park projects, with most in appreciation of the . light hand taken in the management of park forests, and occasional comments reflecting a belief in more intensive management of park resources. The preservation of the character of the historic road alignment, and the quality and proximity of native vegetation adjacent to the road also serves to maintain the ecological integrity of habitat adjacent to the road corridor, and minimizes impacts to threatened and endangered species, and species of concern. The wilderness boundary lies 200 feet from the centerline of most paved roads, so the quality of the roadside forest is critical to the preservation of the park's wilderness characteristics. The NPS Organic Act and the park's enabling legislation direct the park to retain these significant characteristics.

There may be a negligible to moderate impact on visitor enjoyment of the park related when to disturbance from hazard tree treatment operations during the fall. Most visitors would not be affected, although those in proximity to hazard tree removal activities may be affected by noise in portions of developed areas not closed due to safety issues. The short and long-term beneficial effects of hazard tree treatments would far outweigh the minimal short-term effects and inconveniences associated with those treatments by removing hazards that could otherwise adversely affect park visitors.

Visitor Experience Impacts of Alternative 2: Most impacts associated with this Alternative would be the same as described above in Alternative 1; however, under the new Hazard Tree Plan, additional adverse effects would include more visitors potentially being inconvenienced by more temporary and or permanent site closures, while increased beneficial impacts would include:

- fewer trees being felled at the base (with more trees topped) resulting in fewer stumps and more "habitat" trees or snags,
- more consistent treatment of tree safety hazards from the annual monitoring associated with most developed areas, and with the
- loss of trees in developed areas or forest community not exceeding ten percent of the trees in a particular area or forest stand (without additional environmental analysis).

Cumulative Effects/Conclusion: Implementation of this Alternative would result in a minor to major beneficial effect on visitor enjoyment from the removal of known environmental hazards, a negligible to moderate impact on visitor access associated with the treatment of the tree(s) depending on the season, and a negligible to moderate effect on aesthetic characteristics associated with the visitor use area in question, depending on the size and number of trees treated at one time or over time. Noise and activity associated with tree felling operations could

also result in negligible to moderate disruption of visitor use enjoyment and activities, particularly when visitors are present in campgrounds or other park areas during more intensive operations in fall. No impairment of the visitor experience or its values would result.

Impacts to Wilderness

Impacts of Alternative 1: Under this Alternative, the following adverse impacts on wilderness character, particularly the perception of primeval or natural conditions, the degree of solitude and the degree of a primitive, unconfined recreational experience, as well as the following beneficial impacts on the retention of cultural resources in wilderness could occur:

- short-term negligible noise and disturbance associated with tree felling operations that would disrupt wilderness solitude,
- long-term negligible to minor visual impacts from tree felling that would contribute to a decline in the experience of natural conditions and a primitive, unconfined recreational experience in wilderness
- short-term negligible impacts during survey or monitoring of trees in wilderness camps on the experience of natural conditions, and
- long-term minor beneficial effects on the preservation of cultural resources values in wilderness.

While short-term adverse effects could be mitigated by using cross-cut saws or other hand tools, the long-term visual impacts would be mitigated by actions that resulted in the fewest number of trees being cut and when trees were felled, using techniques that minimize the wilderness impact, such as flush cut stumps and a limited degree of cut up timber, while avoiding the placement of cut ends next to visitor use facilities, such as wilderness campsites.

Somewhat frequent (every three years) hazard tree surveys near historic structures in wilderness would aid in the preservation of those structures by early detection of defects and thus retention of the cultural resources values of wilderness.

Impacts of Alternative 2: Wilderness impacts associated with this Alternative would be similar to Alternative 1; however, less frequent surveys of wilderness cultural resources would be coupled with added monitoring. In both Alternatives, leaving material on site, but minimizing visual intrusions would occur. As in Alternative 1, trees throughout most of the park's wilderness would not be surveyed or treated and tree surveys along roads would maximize the proximity of vegetation adjacent to the road (to maintain the Mount Rainier NHLD) and minimize the loss of such vegetation by (to the extent possible) treating the zone between the road and the wilderness boundary similarly to wilderness.

Cumulative Effects: There have been few cumulative impacts on park wilderness over time. Among the greatest, but comparatively negligible has been the creation of nearly 40 backcountry camps. These camps, however, were primarily created, not by removing trees, but by locating campsites amongst existing trees or in areas where the removal of trees had taken place to construct backcountry cabins. In addition, during the mid-1970s, camps located in sensitive subalpine areas were moved, to the degree possible to the more durable forested areas. This has led to the current situation of trees becoming hazardous over time, due to repeated public use occurring at their base. These effects, coupled with the ongoing implementation of the hazard tree program under either Alternative would continue to have a negligible to minor or moderate localized cumulative adverse impacts.

Conclusion: There would be a series of short- and long-term negligible to minor or moderate adverse and beneficial effects and negligible to minor cumulative impacts on wilderness from the continued implementation of the hazard tree program. These impacts would not impair wilderness resources or values.

Impacts to Park Operations

Impacts of Alternative 1: In this Alternative, with *Complete* surveys of campgrounds, picnic areas, trailheads, utilities, wilderness camps, wilderness structures every three years, major developed areas every two years and other areas as reported, administering the park's Hazard Tree Program would continue to require staff dedicated to the identification and analysis of hazard trees, as well as staff to conduct treatment operations. In this Alternative fewer treatment options would be available and more trees would therefore be cut. Although replanting is called for by this Alternative, in practice, it has rarely been undertaken. Taken together the actions called for under Alternative 1 would continue to have a negligible to minor long-term adverse effect on park operations, continuing to affect the responsibilities of a small number of park staff. A long-term negligible beneficial effect would continue to be realized from the removal of some trees deemed hazardous.

Impacts of Alternative 2: Somewhat more staff time would be required to conduct the other types of surveys called for by this Alternative, including *Monitoring* and *Photo-documentation* surveys, than would be required by Alternative 1. *Complete* surveys would occur at the same locations as listed in Alternative 1, however, *Complete* surveys would be added in minor developed areas, overlooks, and on forest nature trails and *Complete* surveys would occur less frequently for utilities, wilderness camps, wilderness structures and could be less frequent than described above for other areas (every three to five years rather than every three years). Annual *Monitoring* surveys would be added at campgrounds, picnic areas, major and minor developed areas, roads and wilderness camps. In addition, in this Alternative, data gathering and analysis for a long-term ecological impacts study as well as additional documentation of the existing program would be added to the array of monitoring data gathering and analysis for the ongoing program. Finally, additional monitoring may take place during or following fires or high winds or other environmental conditions that could affect tree health and survival. Taken together these additional surveys and documentation would result in a long-term minor adverse effect on park operations as well as an indirect long-term moderate beneficial effect from minimizing tree failure problems before they occur.

As in Alternative 1, hazard tree treatment management and operations would include the participation of staff from several areas of park organization and this array of responsibilities is identified more clearly in the revised Hazard Tree Plan in Alternative 2. In addition, the number of treatment options, especially those that require additional training and expertise to perform would require more intensive staff participation in the program.

Increasing the consistency with which hazard tree management decisions are made through a systematic hazard tree decision tree would likely result in a long-term moderate beneficial effect on park operations by reducing the number of trees that are recommended felled rather than topped, trimmed or left untouched and the target removed or area closed. Another beneficial effect would be clear definition of who to contact to identify hazard tress and who to notify regarding potential trees, treatments, closures, etc. There would also be a more efficient response to reducing potential safety hazards and more recognition that there was a comprehensive identification and treatment program in place.

Cumulative Effects: There would be no cumulative effects on park operations from the implementation of the hazard tree program in either alternative.

Conclusion: Taken together the actions called for under Alternative 1 would continue to have a negligible to minor long-term adverse effects on park operations, continuing to affect the responsibilities of a small number of park staff. A long-term negligible beneficial effect would continue to be realized from the removal of some trees deemed hazardous. Taken together additional surveys and documentation in Alternative 2 would result in a long-term minor adverse effect on park operations as well as an indirect long-term moderate beneficial effect from minimizing tree failure problems before they occur. In addition, there would be a series of long-term moderate beneficial effects on park operations by reducing the number of trees that would be felled, rather than to receive some other treatment.

VII. CONSULTATION AND COORDINATION

Public Scoping History
To aid in internal scoping, a press release dated June 27, 2003 was sent to a variety of individuals and organizations on the park's environmental analysis mailing list. Responses were received from the Squaxin Island Tribe and Northwest Ecosystem Alliance. These responses stated that the plan should:

- Define what constitutes a hazardous tree;
- Identify the level of acceptable risk for park visitors;
- Identify the purpose and need for revision to the plan;
- Ensure thorough analysis and sound science when identifying hazardous trees;
- Conduct independent and systematic evaluation of trees (not as a cluster or stand);
- Consider indirect impacts such as wind throw and sunscald;
- Use mitigation that focuses on removing the target rather than the tree or trees;
- Use treatments that reduce the hazard but save the tree;
- Avoid indirect impacts to adjacent trees;
- Prevent impacts by design of recreation facilities;
- Restore areas where hazard trees are removed by replanting;
- Use trees removed for on or off-site restoration;
- State the relationship to fire suppression measures to hazard tree management; and
- Consider Medicine Creek Treaty tribe issues.

These concerns have been integrated into this Environmental Assessment and the Hazard Tree Plan.

U.S. Fish and Wildlife Service (USFWS) Consultation
The initial species list request was sent to the USFWS on January 13, 1999 (response July 11, 2003) and periodically updated thereafter, including on June 27, 2003 and November 10, 2004. On May 11, 2005, a biological assessment was submitted to the USFWS, whereupon there were numerous additional requests for information and consultations between the park wildlife biologist and other staff and the USFWS, ending in a Biological Opinion, received on January 27, 2006. That Biological Opinion concurred with a determination of *May Affect, Not Likely to Adversely Affect* for northern spotted owls, a determination of *May Affect, Likely to Adversely Affect* for marbled murrelets, and a determination of *No Effect* on other species including the grizzly bear, gray wolf, bull trout, Canada lynx and bald eagle, and recommended the conservation measures incorporated into the Special Status Species environmental consequences section in this document. On July 10, 2009 a Biological Opinion amendment was requested of the USFWS for the use of explosives as an option for hazard tree treatment under some circumstances. The USFWS authorized the amendment on July 30, 2009 to use explosives to fell individual hazard trees during the period of October 1 through March 14.

Washington State Historic Preservation Office (SHPO) Consultation
During the public review period for this Environmental Assessment, a request will be sent to the Washington SHPO requesting concurrence with a determination of no adverse effect on historic resources from the actions proposed in the Hazard Tree Plan/Environmental Assessment.

Native American Indian Consultation
Contacts with the Native American Indian Tribes associated with the park also occurred during the public scoping period to determine what concerns should be addressed. A meeting with the Squaxin Island Tribe was held on September 3, 2003 in Longmire. In addition to the formal letter received by the Squaxin Island Indian Tribe, representatives of the Nisqually Indian Tribe, Puyallup Tribe of Indians and the Muckleshoot Indian Tribe have expressed an interest in occasionally procuring trees deemed hazardous for use in continuing their traditional practices. As a result, Alternative 2 in this document incorporates the possibility that the superintendent may, make appropriate surplus wood available for use by Native American Tribes traditionally affiliated with the park.

Public Review of this Environmental Assessment
This environmental assessment will be available for a thirty day public review period beginning from the date it is published to the park's website and mailed to the list of those persons and agencies on the park's mailing list or those who have requested more information about this project. Included among those on the mailing list are local and regional advocacy organizations such as The Wilderness Society, the Sierra Club, The Mountaineers, Mount Rainier National Park Associates, local and regional public libraries, Native American tribes, and individuals and organizations who have requested information about ongoing park projects and events. This document will also be posted on the park's website located at http://www.nps.gov/mora/parkmgmt/planning.html

Comments on this environmental assessment may be submitted electronically by entering them directly into the NPS Planning, Environment and Public Comment website http://parkplanning.nps.gov/mora and clicking on the link associated with the Hazard Tree Management Plan, or submitted in writing to:

Superintendent
Mount Rainier National Park
55210 238th Avenue East
Ashford, WA 98304.

Because of the potential for litigation, the practice of the National Park Service is to make comments, including names, home addresses, home phone numbers, and email addresses of respondents, available for public review. Individual respondents may request that we withhold their names and/or home addresses, etc., but if you wish us to consider withholding this information you must state this prominently at the beginning of your comments. In addition, you must present a rationale for withholding this information. This rationale must demonstrate that disclosure would constitute a clearly unwarranted invasion of privacy. Unsupported assertions will not meet this burden. In the absence of exceptional, documented circumstances, this information will be released. The NPS will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives of or officials of organizations or businesses, available for public inspection in their entirety.

If significant environmental impacts are not identified in the EA by reviewers, this environmental assessment will be used to prepare a Finding of No Significant Impact (FONSI), which will be sent to the Regional Director, Pacific West Region for approval.

For additional copies of this document, please contact Donna Rahier at (360) 569-2211, extension 2301.

The following people and organizations were consulted in the preparation of this environmental assessment.

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Washington State Historic Preservation Office
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Appendix 1

Alternative 1: Hazard Tree Assessment Criteria for Frontcountry and Wilderness

Tree Condition

I. Assign 1 point, if any one or all conditions exist

A. Cat face, scar, frost crack or hollow butt present
B. Fruiting bodies or punk knots on hemlocks present
C. Tree declining or root rot present
D. Cut or exposed roots (>25percent of root mass), inferior rooting system due to shallow or wet soil
E. Dead top or large dead branches (>5" in diameter), pronounced crooks, forked tops, volunteer tops, broken tops or any large branches (>8" in diameter) on hardwoods present
F. Insect frass or pitch tubes present
G. Mistletoe cankers/brooms or stem cankers present
H. Dead tree

II. Assign 1 additional point, if any one or all conditions exist

A. Old trunk scars (>/= 50 years), scars >2 square feet (or >4 square feet on Douglas-fir), open tension or frost cracks, hollow trunk (>/= 6" of wood over ¾ circumference of tree)
B. Numerous fruiting bodies (>5) of *Phellinus pini*, or any *schweinitzii*, *Fomitopsis pinicola*, *Fomitopsis officinalis*, *Echinodontium tinctorium*, *Fomes annosus*, *Phellinus weirii*, *Armillaria mellea*, or *Ganoderma appanatum* and others.
C. Root disease is diagnosed with the presence of fading or chlorotic foliage, thinning crown, distress cone crop or resin flow at base of the tree
D. Cut or exposed roots (>50percent of root mass), or visible soil cracks around roots with shallow rooting or water saturated soil
E. Dead spike, broken or crooked top with large dead branches; large dead branches (>8" in diameter) on hardwoods
F. Carpenter ants or wood boring beetles (not bark beetles) with extensive boring
G. Mistletoe stem cankers present with ½ circumference of the swelling dead
H. Dead tree

III. Assign 1 additional point, if any one or all conditions exist

A. Large open tension or frost cracks, hollow trunk (</= 6" of wood over ¾ circumference of tree, or ½ radius over ¾ circumference on trees < 24" in diameter
B. More than 15 fruiting bodies of *P. pini* or large fruiting bodies (over 8" in diameter) or fruiting bodies of *P. pini, F. pinicola* and *E. tinctorum* within 20 feet of the ground or covering more than 25 feet of trunk or single conk of *F. officinalis* present
C. Root disease present with fruiting bodies of *F. annosus, P. weirii, A. mellea* and/or mycelial fans
D. Cut or exposed roots (>50percent of root mass or root mass lifting on one side or disturbed soil showing
E. Large sections of loose bark, large detached branches or broken branches present
F. Dead tree

IV. Assign 1 additional point, if any one of the conditions exist

A. Tree is a hardwood (e.g. alder, maple or cottonwood)
B. Tree leans more than 5percent and is susceptible to wind throw, saturated soils, shallow rooting, or is adjacent to a blow-down area
C. Tree leans more than 5percent and a structure of value is present.

A maximum total of 4 points can be awarded for tree condition (items I-IV)

Site Condition

I. Assign 1 point, if the following condition exists

A. A target of value other than a structure is present (e.g. historical or cultural)

II. Assign 2 points, if one or the other condition exists

A. The site is commonly inhabited by 10 people or less, less than 100percent of the time in season

B. A structure is present with less than $50,000.00 value

III. Assign 3 points if any one of the conditions exist

A. The presence of major possessions (e.g. automobile, tent or trailer) or groups of 10 or more persons, greater than 10percent of the time in season

B. There are major structures present (e.g. homes, shops, visitor centers) that are more than $50,000.00 in value

C. There is infrastructure present (e.g. power lines, water systems or sewage treatment plants)

A maximum of 3 points can be awarded for site condition (items I-III)

TOTAL RATING FOR HAZARD TREE REMOVAL

Frontcountry areas. . . Remove if hazard rating is greater than or equal to 5

Wilderness areas. . . Mitigate if hazard rating is greater than or equal to 6[#]

[#]Some management action will be taken – not necessarily cutting the tree (see decision criteria)

Appendix 2

Alternative 1: Hazard Tree Assessment Criteria Along Park Roads

Tree Condition

I. Assign 1 point for each of the following conditions that are present

A. Visible lean over road is >10percent
B. Rotted trunk area > solid trunk area of same disc
C. More than ½ roots gone or ¼ roots gone for a dead snag or a leaner
D. Active decay or insects with extensive damage already present (e.g. 2/3 strength of tree gone)

Road Condition

II. Assign 1 point for each of the following conditions that are present

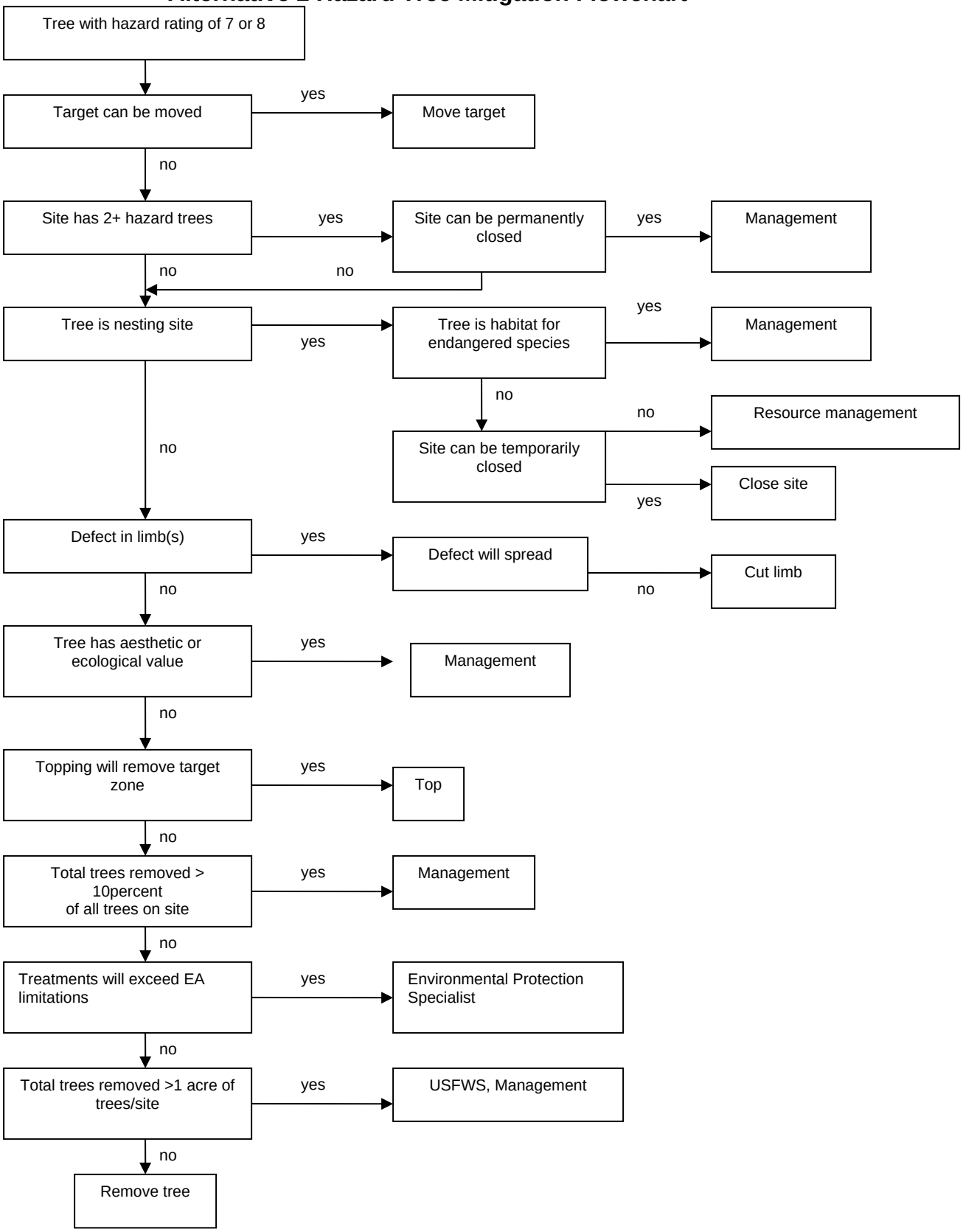
A. Road is heavily used
B. Pull-out or viewpoint
C. On a curve, such that visibility is impaired and stopping distance is diminished (tunnel entrance would apply)
D. Road access is blocked or partially blocked by tree.

A total of 8 points may be assigned for I-II above.

TOTAL RATING FOR HAZARD TREE REMOVAL
Roadside areas. . . Cut if hazard rating is > 4

APPENDIX 3

Alternative 2 Hazard Tree Mitigation Flowchart



Appendix 4

Forest Plant Associations, Community Types and Phases

After Franklin *et al.* 1988 Chapter 5

Association, Community Type or Phase	Common Names	Acres in Park/Unique Characteristics	Potentially Affected Acres in Park *(Watershed noted)*
WET FOREST ECOSYSTEMS			
TSHE/ACTR Association *Tsuga heterophylla/ Achlys triphylla*	Western hemlock Vanilla leaf	677 ^ Confined to low elevations ^ Gentle, lower slopes and valley bottoms ^ Ohanapecosh, White ^ Not resilient under heavy use understory plants sensitive to trampling and soil compaction ^ Most of Ohanapecosh Campground occurs in this forest type ^ Most plots 250 year age range, not described elsewhere therefore likely not climax type ^ Related to ABAM/BENE and TSHE/GASH as well as to ABAM/ACTR not found in park ^ low resistance, high resilience – understory easily trampled but has high rates of recovery	12.4 or 1.84% Ohanapecosh
TSHE or ABAM/POMU Association *Tsuga heterophylla or Abies amabilis phase/ Polystichum munitum*	Western hemlock or Pacific silver fir Sword fern	2,933 ^ Confined to western third of park ^ Low elevation, well-watered ^ Carbon, Mowich, Nisqually, Puyallup ^ Moderate to steep south slopes, some flat valley ^ Climax ^ Very productive ^ Very limited in park	29.3 or 0.99% Nisqually
TSHE/OPHO Association *Tsuga heterophylla/ Oplopanax horridum*	Western hemlock Devil's club	2,914 ^ Occurs in all major valleys ^ Occupies wet benches, terraces and lower slopes at low elevations ^ Carbon, Nisqually, White, Mowich, Puyallup, Ohanapecosh ^ ALRU/RUSP early successional phase ^ Wet soils, high water tables, above average windthrow ^ Ecotones with TSHE/POMU (west)and TSHE/ACTR (east) ^ Related to similar communities elsewhere in Pacific Northwest	10.1 or 0.35% Carbon
ALRU/RUSP Community Type Alnus rubra/Rubus spectabilis	Red alder Salmonberry	Unknown ^ Precursor to TSHE/OPHO and TSHE/POMU ^ All River Valleys ^ Important wildlife habitat (elk, beaver) ^ Little evidence of conifer replacement except after felling, burning and planting	Not affected
ABAM/OPHO Association (valley and slope phases) *Abies amabilis/ Oplopanax horridum*	Pacific silver fir Devil's club	4,347 ^ Higher elevation type of TSHE/OPHO ^ Mid-elevations ^ Carbon, White, Nisqually, Ohanapecosh ^ Steep, lower north slopes, south aspects, even mid and upper slopes ^ Understory varies – dense herb or shrub layer ^ Similar to TSHE/OPHO rich and productive	8.8 or 0.42% Carbon

Association, Community Type or Phase	Common Names	Acres in Park/Unique Characteristics	Potentially Affected Acres in Park *(Watershed noted)*
		^ Most 800+ year old stands belong to this type ^ Heavy elk use ^ Grades to ABAM/TIUM on slightly higher sites ^ Similar communities in other Cascade locations, BC and Rocky Mountains ^ resistant due to shrub dominance (discourages human movement)	
ABAM/TIUN Association (climax and seral phases) *Abies amabilis/ Tiarella unifoliata*	Pacific silver fir Foam flower	11,383 ^ Occupies mesic mountain slopes at mid elevations ^ Occurs throughout park but most common in White and Ohanapecosh ^ Steep southerly slopes, benches and draws or steep north slopes ^ Productive, capable of rapid recovery following disturbance ^ Related to ABAM/RULA ^ Similar to ABAM/ERMO ^ Shrub poor ^ Similar associations elsewhere ^ low resistance, high resilience – understory easily trampled but has high rates of recovery	9.2 or 0.08% Mowich Nisqually
MODAL FOREST ECOSYSTEMS			
ABAM/VAAL Association (VAAL, BENE, RUPE, CHNO phases) *Abies amabilis/ Vaccinium alaskaense or Berberis nervosa or Rubus pedatus or Chamaecyparis nootkatensis*	Pacific silver fir Alaska huckleberry or Oregon grape or Five-leaved bramble or Alaska cedar	26,745 ^ Most extensive type found in park ^ Occupies environments lacking extremes of temperature and moisture ^ Varies widely by phase ^ Ohanapecosh, Carbon, Mowich, Puyallup ^ All aspects ^ RUPE phase distinctive common in OLYM ^ Similar to forests in many locales ^ Part of Cougar Rock Campground ABAM/VAAL ^ Resilient under use and well-suited to developments such as campgrounds and trails ^ Few unique attributes or problems except being common	114 or 0.42% Nisqually Ohanapecosh White
DRY FOREST ECOSYSTEMS			
TSHE/GASH Association *Tsuga heterophylla/ Gaultheria shallon*	Western hemlock Salal	3,030 ^ Moisture and nitrogen deficiencies ^ Hot dry slopes and ridges at low elevations ^ Most common in Ohanapecosh and Nisqually ^ Regeneration of TSHE low ^ Poor growth rates ^ Very even aged stands ^ Heavy browsing by deer, elk and wildlife usage ^ Game trails conspicuous ^ Mosaics with other forest types evident near Ohanapecosh Campground (TSHE/OPHO, TSHE/ACTR, ABAM/VAAL) ^ Similar forests widespread in western WA and OR	80.3 or 2.65% Nisqually Ohanapecosh
PSME/CEVE Community Type	Douglas fir Snowbrush	Unknown ^ Extensive young areas (50-100 years)	Not affected

Association, Community Type or Phase	Common Names	Acres in Park/Unique Characteristics	Potentially Affected Acres in Park *(Watershed noted)*
Pseudotsuga menziesii/Ceanothus velutinus		^ Cowlitz, Ohanapecosh, White ^ Common on recent burns (Shriner) Crystal Mountain ^ Severe hot recent and repeated burns ^ May be dry stage of ABAM/BENE	
PSME/XETE Community Type Pseudotsuga menziesii/Xerophyllum tenax	Douglas fir Beargrass	Unknown ^ Occurs throughout the park ^ Young stands (48-142 years) ^ Gentle to moderate slopes less stressed than PSME/CEVE ^ Low to moderate elevations ^ Possibly early stage of ABAM/GASH or ABAM/XETE	Not affected
PSME/VISE Community Type Pseudotsuga menziesii/Viola sempervirens	Douglas fir Evergreen violet	Unknown ^ Occurs mainly in Cowlitz, Ohanapecosh and White at low to mid elevations ^ Young (72-153 years) ^ Dense herbaceous layer ^ Possibly early stage of TSHE/ACTR or ABAM/VAAL	Not affected
PSME/ARUV Community Type Pseudotsuga menziesii/Arctostaphylos uva-ursi	Douglas fir Kinnikinnick	343 ^ Extremely limited only sampled in Longmire Campground and White River outwash ^ Similar communities described in S WA and N OR ^ Hardy vegetation with moss and lichen ground cover ^ Productivity so low that community often lacks a closed canopy ^ Except for ground cover will tolerate heavy use ^ Rocky surface, high variety of tree species, distinctive ground cover ^ understory easily damaged by trampling, low rates of recovery from severe site conditions (located on glacial outwash and lahars)	?? Nisqually
ABAM/GASH Association Abies amabilis/Gaultheria shallon	Pacific silver fir Salal	2,994 ^ Occurs mostly in western half of park ^ Nisqually, Puyallup, Mowich ^ Moderate to steep, south mid and upper slopes, low to mid elevations ^ Low productivity ^ Resilient plant cover withstands heavy use ^ Prevalence of tree diseases – hazardous trees require special attention ^ Related to TSHE/GASH and ABAM/BENE ^ Similar forests in S WA Cascades, OLYM, OR	Not affected
ABAM/BENE Association Abies amabilis/Berberis nervosa	Pacific silver fir Oregon grape	14,030 ^ Poor habitat in moderately dry, steep slopes at mid elevations ^ Primarily east side White, Ohanapecosh ^ Sparse understory ^ Extensive in White River Shriner Peak, Sunrise Ridge ^ High fire frequency 50-250 year old stands ^ Young stands affected by pathogens such as bark beetle ^ Related to ABAM/VAAL and ABAM/GASH	Not affected

Association, Community Type or Phase	Common Names	Acres in Park/Unique Characteristics	Potentially Affected Acres in Park *(Watershed noted)*
		^ Similar to forests elsewhere	
ABAM/XETE or TSME Association (depending on phase) *Abies amabilis or Tsuga mertensiana/ Xerophyllum tenax*	Pacific silver fir or Mountain hemlock Bear grass	18,885 ^ Poor vegetation composition ^ Located on steep, dry mountain slopes and ridgetops ^ Most extensive in Nisqually but located throughout park ^ Any aspect, mostly south, mostly mid and upper slopes ^ Elevation determines dominate hemlock species ^ Resilient ground vegetation and well-drained soils make it well-suited for trails and campsites ^ Reforestation slow and patchy following fire (Stevens Canyon) ^ Related to ABAM/GASH and PSME/XETE ^ Widespread in WA and Rockies. Absent from OLYM and BC	2.4 or 0.01% Mowich
ABAM/RULA or ERMO Association *Abies amabilis or Tsuga mertensiana/ Rubus lasiococcus* (dry east side) *or Erythronium montanum* (wet west side)	Pacific silver fir/Mountain hemlock Dwarf bramble or Avalanche lily	10,018 ^ Upper slopes, ridge tops, most south aspects ^ Habitat dependent on seed availability at disturbance ^ RULA confined to White River and NE Ohanapecosh River on south and east mountain slopes and ridgetops ^ No management problems ^ Lack heavy shrub cover and saturated soils of TSME ^ Similar forests in S WA and N OR, OLYM	2.4 or 0.01% Nisqually
ABLA2/VASI Community Type Abies lasiocarpa/Valeriana sitchensis	Subalpine fir Sitka valerian	7,655 ^ Warm south slopes at high elevations ^ Young (100-200 years old) ^ Highest fire frequency in park (275 years) ^ White and Ohanapecosh ^ Early stage of ABAM/RULA ^ Often adjacent to meadows ^ Sunrise Ridge, Grand Park ^ Moderately resilient to impacts – suitable for backcountry camping ^ Similar forests elsewhere in WA – High Rock, Glacier Peak, Goat Rocks, OLYM	Not affected
ABAM/RHAL Association *Abies amabilis/ Rhododendron albiflorum*	Pacific silver fir White-flowered rhododendron	13,297 ^ Shrubby high elevations on cool wet slopes and benches ^ Most north aspect, some south ^ Heavy snowpack (5 m or more) lasting well into summer ^ Dense tangle of shrubs ^ Unsuitable for trails and backcountry campsites ^ Related to CHNO/VAOV ^ Similar forests reported from Cascades	0.3 or 0.01% Mowich
CHNO/VAOV Association *Chamaecyparis nootkatensis/ Vaccinium ovalifolium*	Alaska cedar Oval leaf huckleberry	471 ^ Wet, nearly swampy sites throughout park ^ Wet benches, draws and lower slopes ^ Relatively uncommon ^ Any aspects, but most north ^ Poor environment for trails and totally	Not affected

Association, Community Type or Phase	Common Names	Acres in Park/Unique Characteristics	Potentially Affected Acres in Park *(Watershed noted)*
		unsuited for campsites ^ Wet soils, numerous seeps, springs and streams ^ Often associated with wet meadows, bogs, fens and ponds ^ Related to ABAM/RHAL ^ Not described from other forests ^ deep persistent snowpacks	
ABAM/MEFE and TSME Association (climax or seral phases) *Abies amabilis/ Menziesia ferruginea*	Pacific silver fir or Mountain hemlock False azalea	4,199 ^ Common throughout park ^ Shrub dominated mid to high elevation ^ Relatively cool, moist, moderate to heavy snowpack ^ Similar forests in Cascades and Rockies	1.5 or 0.04% Mowich

Appendix 5
Alternative 2: Hazard Tree Evaluation Form

Observer name(s)_____ Date_____

Tree ID #_____ Location_____
_____
Species_____ DBH_____ Height_____ Reference_____
_____ Bearing_____ Distance_____
Shell thickness_____ Possible origin of damage_____

EVALUATION OF TREE CONDITION: 1 POINT IF ANY CONDITIONS LISTED BELOW ARE PRESENT
____ large scar (2-4 sq ft), frost cracks, hollow butt, bole flattening
____ fruiting bodies, or punk knots on hemlock
____ callus tissue at base, stem cankers
____tree declining or possible root rot
____ cut/exposed roots (>25% of root mass), bad rooting, shallow or wet soil
____ dead top, large dead limbs (>5" dia), crooks, forked top, volunteer top, any large limbs (>8" dia) on hardwoods
____ insect frass or pitch tubes
____ mistletoe cankers or brooms
____ woodpecker holes
____ tree dead **TOTAL:_____**

ADD 1 POINT IF ANY OR ALL CONDITIONS BELOW ARE PRESENT:
____ old bole scars (>15 years), scars 2 sq ft (4 sq ft on PSME), open tension or frost cracks, swollen butt, stem decay, hollow/rotten trunk (remaining wood < Wagener's minimum safe shell thickness)
____ >5 conks of F. pini; any conks of F. officinalis, E. tinctorum, F. applantus, F. annosus, P. weinii, or A. mellea
____ root disease diagnosed by fading or chlorotic foliage, thinning crown, distress cone crop, tip dieback, or resin flow at base of tree
____ cut/exposed roots (>50% of root mass), or visible soil cracks around roots with shallow rooting or water-saturated soil
____ dead, broken or crooked top with large dead limbs, large dead limbs (>8" dia) on hardwoods
____ carpenter ants/wood boring beetles present (not bark beetles), with extensive boring
____ mistletoe stem cankers with 1/2 circumference of swelling dead
____ split bole, longitudinal cracks in bole
____ tree dead **TOTAL:_____**

ADD 1 POINT IF ANY OR ALL CONDITIONS BELOW ARE PRESENT:
____ large open tension or frost cracks, hollow/rotten trunk (remaining wood < Wagener's minimum safe shell thickness)
____ >15 conks of F.pini, or any large conks >8" dia, or conks of F. pini, F. pinicola, or E. tinctorum within 20 ft of ground or covering more than 25 ft of stem, or a single conk of F. officinalis
____ root disease present, with conks of F. annosus, P. weinii, A. mellea, P. schweinitzii, and/or advanced decay present in roots and/or butt of tree and/or mycelial fans
____ cut/exposed roots (>50% of root mass), or root mass lifting on one side or disturbed soil showing
____ large sections of loose bark, large detached limbs or broken limbs present
____ tree dead **TOTAL:_____**

ADD 1 POINT IF ANY OR ALL CONDITIONS BELOW ARE PRESENT:
____ tree leans >5% (uncorrected), is highly susceptible to wind, has saturated soil or shallow rooting
____ fresh longitudinal cracks in bole
____ forked top with evidence of crotch weakening

TOTAL:_____
TREE CONDITION TOTAL:_____

EVALUATION OF TARGET (circle one)

1 = No damage or injury	any area used intermittently roadside pullouts no structures
2 = Minor damage	day-use picnic areas, parking spurs developed nature trails
3 = Moderate damage	campsites major road bridges primary utility structures
4 = Extensive damage	permanently occupied structures concentrated use in season high value improvements-houses, restrooms campsites open year-round, power lines, etc.

TARGET VALUE:________

Add Tree Condition Total and Target Value = **TREE HAZARD SUMMARY RATING:________**

Observer comments:

____

____

____

____

Tree location map:

~~~~~~

Recommended action:

____

____

____

Treatment taken:

____

____

____

Post Treatment Evaluation of Defects:

____

____
~~~~~~

Appendix 6
Alternative 2: Tree Failure Form

Name of site: _____ Report by: _____

Date: _____ Agency and unit: _____

A) Tree and Stand

Tree species _____

Approx. dbh _____

Forest type _____

Elevation _____

Stand age class _____ Overmature
_____ Mature
_____ Young-growth
_____ All-age

B) Class of mechanical failure

_____ Upper bole (top half)
_____ Lower bole
_____ Butt (lower 6 feet)
_____ Limb
_____ Soil (roots pull out of soil)
_____ Root failure (major roots fail)

C) Defect or fault leading to failure

___ Rot (trunk, limb or root)
___ Sweep
___ Tree dead - snag
___ Fire wound
___ Lightning wound
___ Mechanical wound
___ Leaning
___ Cracks or splits
___ Fork or multiple top
___ Twin bole or basal fork
___ Dead top or branch
___ Widow-maker or hang-up
___ Canker, rust
___ Canker, mistletoe
___ Other _____
___ Unknown or none

D) Contributing factors

____ Wind ____ Stream bank erosion
____ Snow ____ Shallow rooting
____ Erosion _____ Tree striking tree
___ Soil saturation ____ Other:_____
____ Unknown or none

E) Time and place of incident

Approx. hour _____

Date or month, year _____

Forest/district _____

County, State _____

During season of public use: ___ Yes ___ No

F) Land ownership

____ Federal
____ State
____ Other public _____
____ Private
____ Public utility

G) Site category

____ Developed campground
____ Developed picnic ground
____ Other developed public-use site
____ Marked trail
____ Roadside
____ Residence
____ Other _____

H) Property or person affected

____ Agency ____ Contractor
____ Recreationist ____ Public utility
____ Forest industry
____ Permittee/Concessionaire
____ Other _____

G) Consequences

____ Clean-up work required
____ Damaged property: _____
Loss estimate: $ _____
____ Injury
____ Medical attention required
____ Fatality

Appendix 7
Minimum Tool Requirement Form

Wilderness Minimum Tool Guidelines (from Mount Rainier National Park Office Order No. 87-1)

Office Order No. 87-1 (revised 6/25/90) establishes administrative procedures for activities that are otherwise prohibited in Title 36 CFR. 36 CFR Section 1.2 (e) allows for a waiver of prohibitions for administrative purposes and emergencies.

The Park-specific policy allows for the use of mechanized equipment affecting Wilderness provided that it adheres to minimum tool guidelines. To perform administrative work that includes the use of mechanized equipment, written justification will be submitted on the MINIMUM TOOL JUSTIFICATION FORM FOR WILDERNESS (attached) prior to the proposed work. Division Chiefs should identify recurring types of events such as human waste removal from Camp Muir and Camp Schurman, helicopter lift of trail materials except from July 1 through Labor Day, aerial wildlife surveys, aerial photo inventories and emergency operations (SAR and fire). Approved application will be reviewed every three years for appropriateness and consistency. The Chief of Maintenance will be responsible for the review.
For other non-recurring uses of mechanized equipment affecting Wilderness, a MINIMUM TOOL JUSTIFICATION FORM FOR WILDERNESS will be prepared and approved by the Superintendent prior to the proposed event. This form should be attached to all A-70 Aircraft Use Request forms when they are submitted to the Visitor Management Specialist for signature unless previous approval is on record. In that case, simply reference the approval number.

Administrative Use of Mechanized Equipment (from Mount Rainier National Park Wilderness Management Plan, pg. 97; 1989)

Park use of power equipment in Wilderness is dictated by Office Order 87-1. The use of mechanical equipment is constrained by the Wilderness Act and National Park Service Policy. In determining the appropriate minimum tool for use in the Wilderness, consideration will be given to disturbing the visitor's Wilderness experience, public safety, and effects on Wilderness resources. Resource protection and safety concerns will take precedence over economic considerations. Alternative methods to power tools will be considered based on the project's objectives and minimum tool concerns. Use of power tools in Wilderness will be given to disturbing the visitor's Wilderness experience, public safety, and effects on Wilderness resources. Resource protection and safety concerns will take precedence over economic considerations. Alternative methods to power tools will be considered based on the project's objectives and minimum tool concerns. Use of power tools within Wilderness will be confined, as much as possible, to the period prior to July and after August. Use of helicopters, if determined to be the minimum tool, will be limited to before July 1 and after Labor Day and use is restricted to weekdays.

Approval for use of helicopters in non-emergency situations may be granted only if it has been determined to be the minimum tool to achieve the purposes of the area or for protection of Wilderness values.

YR_____#_____ PEPC ID_____

Minimum Requirement / Minimum Tool Analysis

Completed By Project / SUP Manager:

1) One time project? Yes / No Recurring? (how often) _____

2) Project/Action Location and Description:

3) Mechanized equipment requested? No _____
Chain Saw _____ Power Tools _____ Helicopter_____ (A70 # _____)
Rock Drill _____ Generator _____ Fixed Wing_____ (A70 # _____)
Explosives _____ Snowmobile _____ Other _____

4) Date(s) of Action: _____ Duration: _____

5) Describe alternatives on how task would be accomplished without use of mechanized equipment and/or less intrusive actions (ie: primitive tool, education, not in wilderness, etc)

6) Describe impacts to wilderness resource/values AND visitor use of above alternative(s):

Signature_____ Date_____
Project Manager

Completed By Wilderness Coordinator:

7) Minimum Requirement Analysis: Is the project or activity consistent with, or necessary to meet the minimum requirements for the administration of the area as wilderness, without imposing a significant impact to the wilderness resources, and character?

8) Minimum Tool Analysis: Will the selected tool or method used to complete the project result in the least overall impact to the physical resources and experiential qualities (character) of wilderness?

9) Describe the beneficial and detrimental effects on Wilderness values if the selected alternative is accomplished.

Recommendation: _____

Signature _____ Date_____
Wilderness Coordinator

Recommendation: _____ NEPA Project # _____

Signature _____ Date_____
Environmental Compliance Specialist

Recommendation: _____

Signature _____ Date_____
Superintendent

Comments:

Revised 5/07

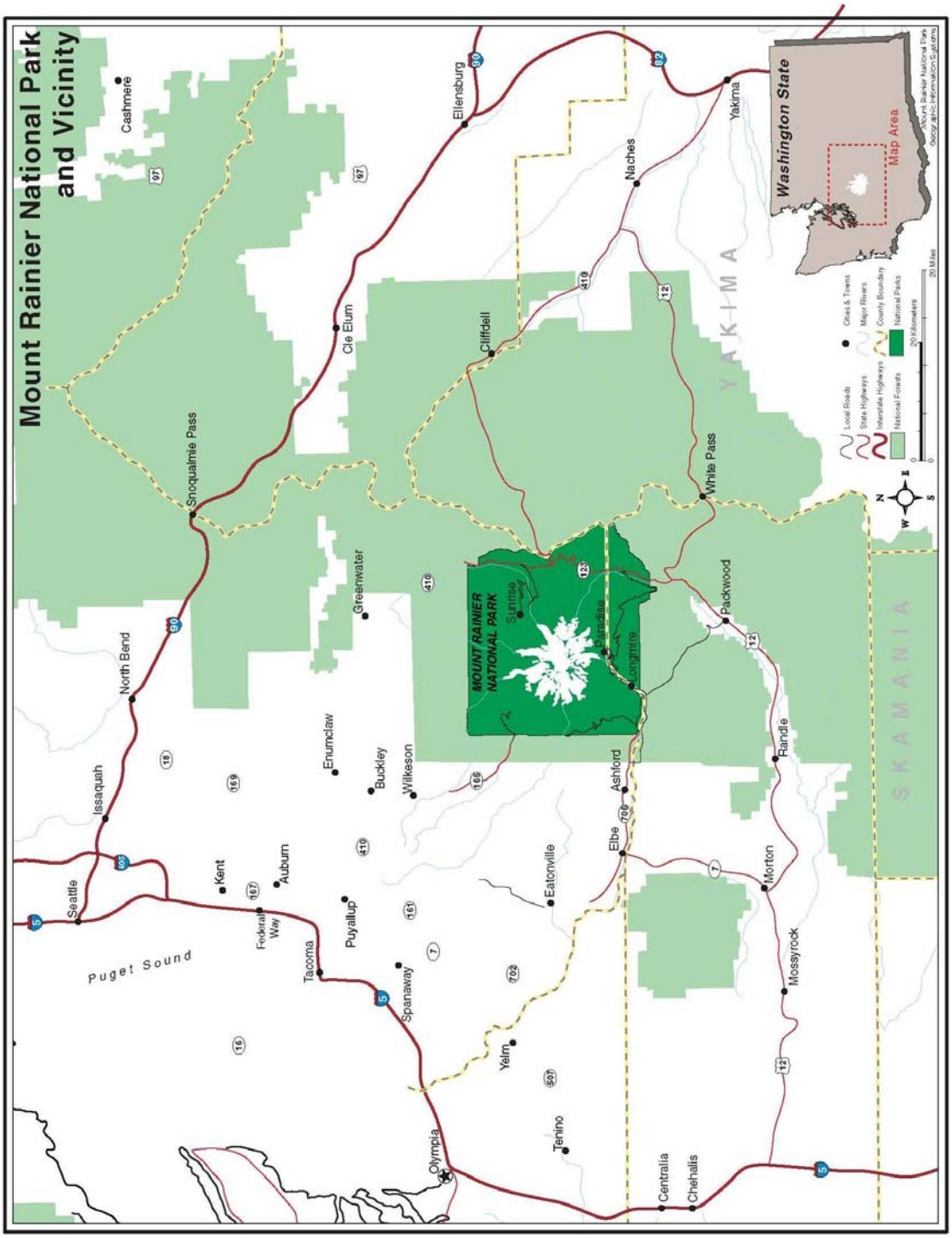


Figure 1. Mount Rainier National Park

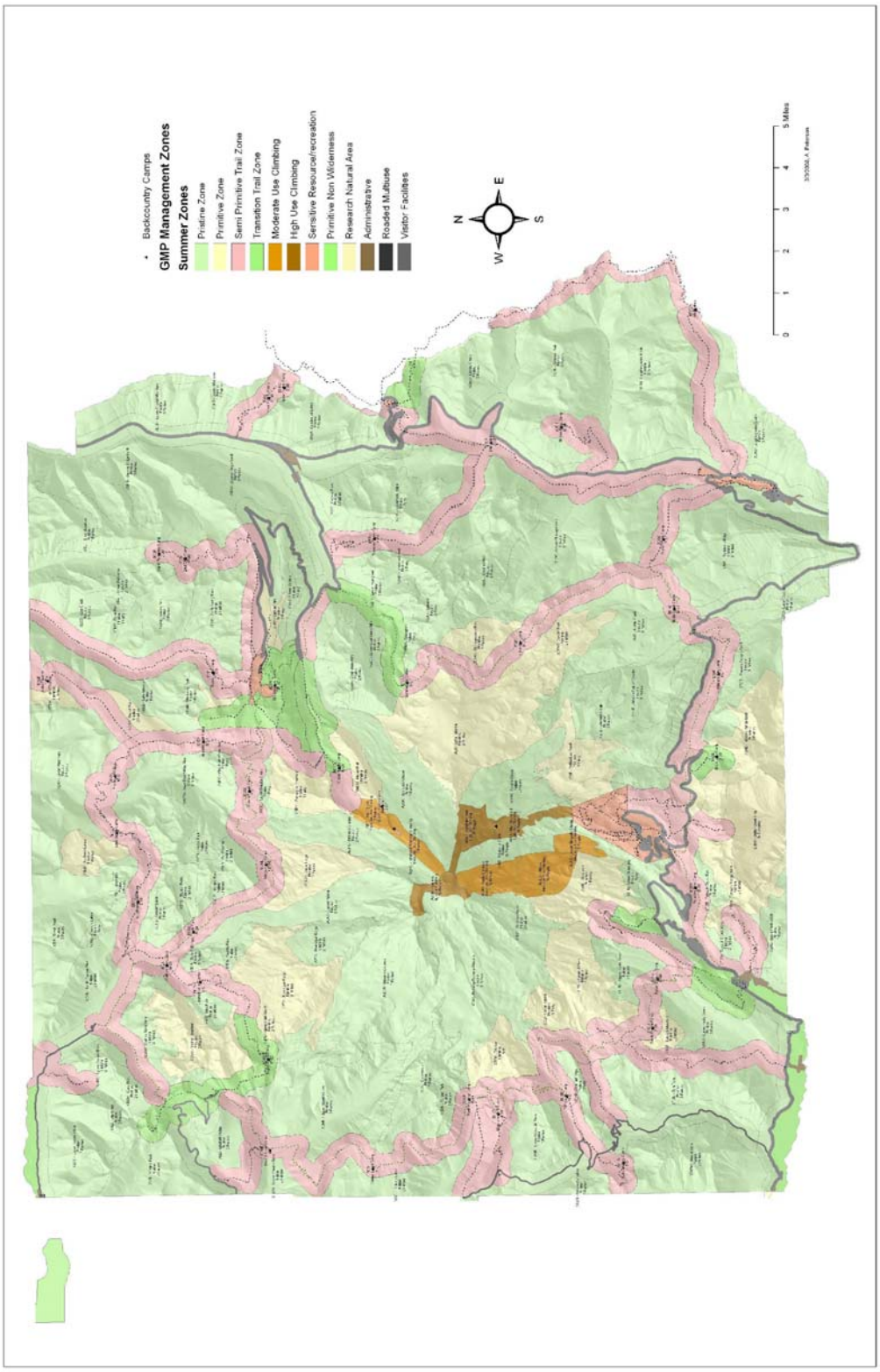


Figure 2. Mount Rainier National Park backcountry camps and GMP management zones.