National Park Service
U.S. Department of the Interior

Glacier National Park
Waterton – Glacier International Peace Park
Montana

Draft Hazard Tree Management Plan
Environmental Assessment

September 2008

Environmental Assessment

Draft Hazard Tree Management Plan

Glacier National Park • Montana
Waterton-Glacier International Peace Park

SUMMARY

The purpose of the park's draft *Hazard Tree Management Plan* (HTMP) is to provide guidelines to identify and assess what represents a hazard tree and identifies a range of management actions to select from to reduce the hazard within all management zones while considering ecological concerns. While most hazard tree work takes place in the visitor service zone, some structures and designated campgrounds in the backcountry zone require protection from damage caused by hazard trees. The draft HTMP also would assign responsibilities for carrying out the program.

The objectives of the Hazard Tree Management Program are as follows with their associated sub-objectives that would better achieve the objectives:

- Assure park-wide consistency and continuity in hazard tree surveys, ratings, documentation, and evaluation of management alternatives.
    - Clarify management zones used for setting priorities
    - Clarify responsibility of hazard tree management along road corridors
    - Clarify locations and responsibilities for cutting trees in the backcountry management zone
- Implementation of a systematic, yet ecologically sound, program that provides regular prioritized surveys, evaluation of potentially hazardous trees, and treatment.
    - Clarify the type of hazard tree monitoring to be conducted
- Preservation of ecosystem dynamics and structure, particularly the age classes and species diversity, while reducing hazards.
    - Clarify the procedures for dealing with downed trees
    - Implement guidelines for planting young trees as mitigation for tree removal

This Environmental Assessment (EA) evaluates two alternatives: a No Action alternative and an Action alternative (the Preferred alternative). The No Action alternative would continue managing hazard trees in the park as directed in the 1994 *Hazard Tree Management Plan*, under management zones that are no longer used and were replaced by the new zones described in the 1999 *General Management Plan* (NPS 1999a). The 1994 plan did not include guidance for backcountry tree removal, monitoring, disposition of downed trees or mitigation for the loss of trees. The Preferred alternative described in this Draft Plan would implement a new *Hazard Tree Management Plan* (HTMP) that would be consistent with management zones developed in the 1999 *General Management Plan;* provide guidance for monitoring, a protocol for evaluating trees with obvious defects or damage, decision making tools to determine, the fate of identified

hazard trees and mitigation for the loss of trees. The Preferred alternative also addresses management of hazard trees in established backcountry campgrounds and around historic backcountry cabins. Once approved, this new plan would replace the 1994 *Hazard Tree Management Plan*.

Impact topics analyzed were vegetation, wildlife, threatened and endangered species, ethnographic resources, public health and safety, and recommended wilderness. The Preferred alternative would have minor, temporary, localized and adverse impacts on vegetation as some trees from developed and backcountry areas of the park would be felled. Wildlife, including bald eagles, would experience minor, long-term, localized and adverse impacts from implementing the preferred alternative as a hazard tree treatment action has the potential to fell a tree that is inhabited by a wildlife species. The Preferred alternative could have minor, long-term, localized and adverse impacts to ethnographic resources if culturally scarred trees became hazard trees and had to be treated. The preferred alternative would have moderate, long-term, localized and beneficial impacts to public health and safety as hazard tree treatment would fell trees and limbs, alleviating the potential to harm visitors, staff or property. Negligible to minor, long-term, localized and adverse impacts would be imposed on recommended wilderness values as a result of visible remaining stumps and the potential for temporary unnatural noise.

How to Comment

Comments can be provided directly through the Park's planning website (http://parkplanning.nps.gov/parkHome.cfm?parkId=61) by selecting this project. In order to reduce paperwork and streamline project efforts, electronic comments are encouraged. However, one may write to: Superintendent, Glacier National Park, Attn: *Hazard Tree Management Plan* EA, PO Box 128, West Glacier, Montana 59936. This draft plan and environmental assessment (EA) will be on public review for 30 days. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. We 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.

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PURPOSE AND NEED

BACKGROUND

Glacier National Park consists of 1,013,572 acres situated on the Canadian border in the northwestern section of Montana (Figure 1). The park is in the Rocky Mountains in the northern United States, and contains rugged mountains along the Continental Divide. Together with Canada's Waterton Lakes National Park, it forms the Waterton-Glacier International Peace Park, and is an International Biosphere Reserve and World Heritage Site. Superb natural and cultural resources are found in both parks.

The purpose of Glacier National Park is to:

- Preserve and protect natural and cultural resources unimpaired for future generations (1916 Organic Act);
- Provide opportunities to experience, understand, appreciate, and enjoy Glacier National Park consistent with the preservation of resources in a state of nature (1910 legislation establishing Glacier National Park); and
- Celebrate the on-going peace, friendship, and goodwill among nations, recognizing the need for cooperation in a world of shared resources (1932 International Peace Park legislation).

Glacier's significance is explained relative to its natural and cultural heritage:

- Glacier's scenery dramatically illustrates an exceptionally long geological history and the many geological processes associated with mountain building and glaciation;
- Glacier offers relatively accessible spectacular scenery and increasingly rare primitive wilderness experience;
- Glacier is at the core of the "Crown of the Continent" ecosystem, one of the most ecologically intact areas remaining in the temperate regions of the world;
- Glacier's cultural resources chronicle the history of human activities (prehistoric people, American Indians, early explorers, railroad development, and modern use and visitation) show that people have long placed high value on the area's natural features; and
- Waterton-Glacier is the world's first international peace park.

Glacier National Park has been divided into six well-known geographic areas (Figure 1), each with its own management philosophy: Many Glacier, Goat Haunt-Belly River, Going-to-the-Sun Road corridor, Two Medicine, Middle Fork, and North Fork (NPS 1999a). The six geographic areas each contain up to four management zones: the visitor service zone, the day use zone, the rustic zone, and the backcountry zone. Each of the four management zones has a different set of desired resource conditions, visitor experiences, management activities, and development. The draft *Hazard Tree Management Plan* would address actions in all the geographic areas of the park and in all four management zones.

The visitor service zone includes developed areas, paved roads, and campgrounds with potable water and sanitation facilities. Natural resources are managed to protect visitor health and safety, promote enjoyment of the setting, and mitigate the effects on surrounding areas.

The day use zone includes selected areas with specific destinations that visitors could reach easily within a day from visitor use zones. Natural resources are managed to ensure a high degree of resource integrity, enhanced by proper location and design of trails and facilities.

Resource degradation is not allowed outside the trail corridor. Some parts of this zone are within the park's recommended wilderness.

The rustic zone includes primitive facilities and campgrounds representative of the early western national park development and traditional visitor experiences in them. Modest impacts on natural resources are tolerated, mostly near campgrounds and facilities.

The backcountry zone includes the park's entire recommended wilderness, and encompasses more than 95% of the park. Management of natural resources focuses on protection and restoration of resources and natural processes. Visitors may hike, camp, and horseback ride in this zone. There are some historic structures and designated campsites in the backcountry zone which require protection from hazard trees. This zone also contains some primitive trails, but the draft *Hazard Tree Management Plan* does not cover removal of trees along trails.

Not all trees with diseases or structural defects are hazardous, only those that are significantly weakened. Trees that do not have a target are not hazard trees, regardless of their condition. Trees with no detectable defects might fall during extreme wind events, soil saturation or due to unknown causes.

PURPOSE

The 1994 *Hazard Tree Management Plan* requires revision. It only addressed management of hazard trees in the front country developed areas within the visitor service zones in the park and did not address areas in the backcountry zone such as designated campsites. The National Park Service proposes to replace the 1994 *Hazard Tree Management Plan* with a new plan that includes guidelines for hazard tree management in all zones in the park. Hazard trees are those trees that, due to disease or structural failure, are at imminent risk of falling and striking stationary targets. The draft *Hazard Tree Management Plan* (HTMP) would provide guidelines to identify and assess what represents a hazard tree and identifies a range of management actions to select from to reduce the hazard within all management zones while considering ecological concerns. While most hazard tree work takes place in the visitor service zone, some structures and designated campgrounds in the backcountry zone require protection from damage caused by hazard trees. The draft HTMP also would assign responsibilities for carrying out the program.

The objectives of the Hazard Tree Management Program are as follows with their associated sub-objectives that would better achieve the objectives:

- Assure park-wide consistency and continuity in hazard tree surveys, ratings, documentation, and evaluation of management alternatives.
    - Clarify management zones used for setting priorities
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Figure 1. Conceptual Representation of Management Zones and Geographic Areas of GNP

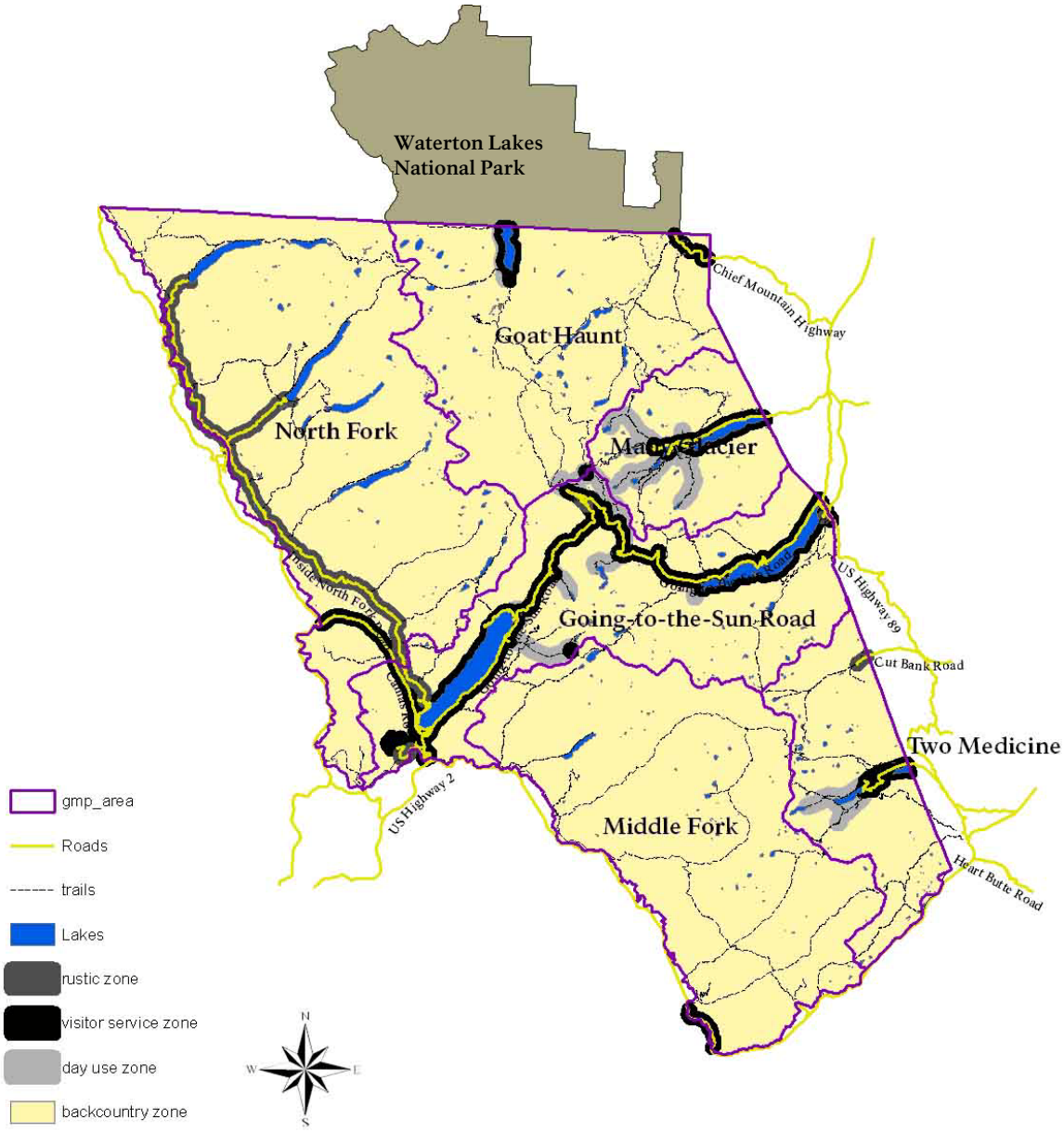


Photo 1. Hazard tree near target (public bathroom); note the rot mid-tree

Photo 2. If left untreated, hazard tree can damage park property

NEED

Approximately 57% of Glacier National Park is forested. Numerous public facilities and roads as well as a small number of private homes are situated within these forests. Visitation continues to increase with an average of 1.9 million visitors using the park's roads and facilities each year. The potential exists for weakened trees or portions of trees to fall and stationary targets in established development areas or backcountry campgrounds. Current drought conditions might also be stressing trees, resulting in the presence of more hazard trees. Park management has the responsibility to assess and reduce risks resulting from hazardous trees in developed locations in the park.

The enabling legislation for the park as well as the Organic Act of the National Park Service mandates the conservation of the biological and historical diversity while providing for enjoyment by the people. Several NPS management policies provide guidance for reducing the risk to the public and park employees/contractors and protecting park structures that relate to hazard tree management:

- Section 8.2.5.1 of NPS *Management Policies* (NPS 2006a): Policies and principles to guide the National Park Service's public risk management program. According to those policies and principles, the saving of human life takes precedence over all other management actions. While recognizing that competing concerns often restrict the Service's ability to eliminate hazards, the Service will strive to protect human life and provide for an injury-free visit, doing so within the constraints of the 1916 Organic Act and available resources.
    - Director's Order #80: *Asset Management* (approved November 2006): The NPS will strive to locate, design, build, operate, and maintain facilities so as to minimize natural and man-made hazards. All visitor facilities will be inspected on a regular basis to identify and mitigate unsafe conditions. If it is not possible to correct an unsafe condition, the NPS will take reasonable action to protect the public from that condition.
    - Director's Order #50C *Public Risk Management Program* (under review)*:* Recognizes that park users are expected to understand that there are inherent risks and potential consequences associated with visiting NPS sites. In recognizing this, the park is committed to reducing these risks as appropriate, especially in areas where the park requires utilization, such as designated campgrounds in the backcountry zone.

Therefore, it is the policy of Glacier National Park to manage the park resources in a natural condition while providing for reasonably safe recreational opportunities to the public. Park managers work to reduce risk to visitors, and other park employees where appropriate, without jeopardizing the natural and cultural resources that the park was designated to protect. Visitors come to the park to experience its natural and cultural heritage and in doing so accept some inherent risks not encountered in more developed locations. This is especially true when visitors travel into the backcountry and day use zones. This plan provides managers and the public with guidelines as to how hazard trees are managed in all management zones of the park.

The primary impetus for developing a Hazard Tree Management Program is to reduce risks to visitors, employees and structures as directed in the Visitor Safety section of the *NPS Management Policies* (NPS 2006a).

The 1994 *Hazard Tree Management Plan* did not include an environmental assessment (EA). Since the park is updating this plan, this EA was prepared in accordance with the National Environmental Policy Act.

RELATIONSHIP OF THE PROJECT TO PREVIOUS PLANNING EFFORTS

Activities proposed in this document are consistent with the objectives of Glacier National Park's *General Management Plan* (NPS 1999a), as well as the 1994 *Hazard Tree Management Plan* (NPS 1994).

The *Hazard Fuels Management Plan* (NPS 2004a), required by the park's Fire Management Plan, is part of the park's fire program (not to be confused with the *Hazard Tree Management Plan*). Although some trees that might be considered hazard trees could be removed during fuel reduction activities, the objective of the *Hazard Fuels Management Plan* is to create a defensible buffer around developments to allow firefighters to effectively suppress fires threatening structures. This is done through removal of understory fuels and thinning of trees within 500 feet of structures.

Hazard trees created as a result of wildland fire would not be addressed in this plan as they would be evaluated separately under a *Burned Area Emergency Rehabilitation (BAER) Plan* or earlier as part of normal mop-up operations. This will be done under the direction of the park's resource advisor.

APPROPRIATE USE

Sections 1.4 and 1.5 of *Management Policies* (2006) direct that the National Park Service must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. A new form of park use may be allowed within a park only after a determination has been made in the professional judgment of the park manager that it will not result in unacceptable impacts.

Section 8.1.2 Of Management Policies (2006), *Process for Determining Appropriate Uses*, provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for

- consistency with applicable laws, executive orders, regulations, and policies;
- consistency with existing plans for public use and resource management;
- actual and potential effects on park resources and values;
- total costs to the service; and
- whether the public interest will be served.

Park managers must continually monitor all park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it. More information on the definition of unacceptable impacts as cited in §1.4.7.1 of *Management Policies* (2006) can be found in the Affected Environment and Environmental Consequences section.

An up-to-date Hazard Tree Management Plan would provide guidelines to identify and assess what represents a hazard tree and identifies a range of management actions to select from to reduce the hazard within all management zones while considering ecological concerns and assign responsibilities to carry out the program. The draft Hazard Tree Management Plan is consistent with the park's general management plan and other related park plans. With this in mind, the NPS finds that applying the management decisions found in the Hazard Tree Management Plan is an acceptable use at Glacier National Park.

PUBLIC INVOLVEMENT (SCOPING)

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in an environmental assessment. Glacier National Park conducted both internal scoping with appropriate National Park Service staff and external scoping with the public and interested and affected groups and federal, state and local agencies.

Internal scoping defined the purpose and need, identified potential actions to address the need, determined what the likely issues and impact topics would be, and identified the relationship, if any, of the proposed action to other planning efforts at the park.

Public scoping was conducted in September, 2003 by mailing out letters to individuals and groups on the park mailing list and asking for comments and concerns. A press release was issued on September 16, 2003. Three letters and emails were received. One author stated they were in support of updating the plan especially if it meant reducing the risks in the visitor service zone. Another author also supported the project and wanted the park to consider monitoring and removing live trees that could also be considered hazards. The draft plan addresses removal of dead and live trees if they meet the definition of a hazard tree.

The State Historic Preservation Office noted that culturally scarred trees could be inadvertently felled if employees are not trained to identify these resources. The SHPO suggested the NPS include a process for identifying these trees in the proposed action. In a December, 2003 meeting with the Confederated Salish and Kootenai Tribal Historic Preservation Department (CSKT) the staff also expressed concern about properly identifying culturally scarred trees. The CSKT suggested providing training to work crews to identify these trees and that if such a tree does become a hazard, it should be detached above the scar. In a separate December, 2003 meeting with the Blackfeet Tribal Business Council Liaison, the tribe said they had no concerns about hazard tree management.

The undertakings described in this document are subject to Section 106 of the National Historic Preservation Act, as amended in 1992 (16 USC Section 470 et seq.). Consultations with the Montana State Historic Preservation Office (SHPO) have been ongoing since the inception of the project. This environmental assessment will also be submitted to the SHPO, the Confederated Salish and Kootenai Tribes, and the Blackfeet Tribal Business Council for review and comment.

IMPACT TOPICS

Resources that might be affected by the alternatives were identified by National Park Service staff and other federal and state agencies. Impact topics were derived from these resources. The following impact topics were identified on the basis of federal laws, regulations, orders, and National Park Service Management Policies, and input received during scoping. A brief rationale for the selection of these impact topics is given below, as well as the rationale for dismissing the rest of the impact topics from further consideration.

TOPICS SELECTED

Vegetation

The proposed plan would involve removal of some trees from areas within all management zones of the park; therefore vegetation is included as an impact topic in this EA.

Wildlife

The proposed plan would involve the use of chain saws and human presence in the park's backcountry zone, and in visitor service, day use, and rustic zones in the spring and fall, which might disturb some wildlife including wolves and prey of threatened species. Also, some hazard trees might support wildlife species which nest or roost in trees.

Bald eagles frequently use snags for perching especially near lakes. In recent years, several trees known to be used by bald eagles have also been identified as hazard trees. The continued removal of hazard trees in developed areas near lakes could impact bald eagles. Protection under the Migratory Bird Treaty Act serves to protect environmental conditions for migratory birds from pollution or other ecosystem degradations. Therefore, wildlife is included as an impact topic in this EA.

Threatened and Endangered Species and Species of Concern

The Endangered Species Act (ESA) of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the ESA requires all federal agencies to consult with the U.S. Fish and Wildlife Service (or designated representative) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. In addition, the 2006 *Management Policies* and NPS 77: *Natural Resources Management Guidelines, Chapter 2* require the National Park Service to examine the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species (NPS 2006a).

There are three federally threatened wildlife species, the bull trout, Canada lynx, and grizzly bear inhabiting GNP and one federally endangered species, the gray wolf. Grizzly bears (*Ursus arctos horribilis*) could be temporarily displaced by human activity and noise caused by chainsaws and explosives during tree removal. Therefore, under Section 7 of the ESA, threatened and endangered species are included as an impact topic. Since bull tout, gray wolf and Canada lynx would not be affected, they are dismissed from further consideration.

Ethnographic Resources

Culturally scarred trees could become hazard trees. The proper identification of these trees and determining how to manage them would be addressed in the plan. Therefore, they are included as an impact topic in this EA.

Public Health and Safety

The proposed plan would fell trees and detach limbs which represent hazards to reduce the risk to visitors while they occupy designated campgrounds and explore historic structures in all management zones. Risks dramatically increase to backcountry visitors when hazard trees are present in areas where visitors are encouraged to camp. Medical injuries resulting from hazard trees falling could cause emergency evacuations. Therefore, public health and safety are included as an impact topic in this EA.

Recommended Wilderness

The 1964 Wilderness Act (16 USC 1131 *et seq.*) provides for protection of wilderness for future generations. Because most of the backcountry zone of Glacier National Park is recommended wilderness, it is managed as designated wilderness in accordance with NPS policy (NPS 1999a). Management of natural resources in the backcountry zone focuses on protection and restoration of resources and natural processes (NPS 2006b). Ordinarily, recommended wilderness would be exempt from hazard tree inspections and removal but since the park has designated

campgrounds and has historic cabins in recommend wilderness it is obligated to remove unnecessary risks such as hazard trees.

The proposed plan would involve the use of various tools (see Section 6 – Minimum Requirement/Minimum Tool Analysis Worksheet) to fall hazard trees in designated campgrounds and around historic structures in the backcountry zone. Therefore, wilderness is analyzed in this EA.

IMPACT TOPICS DISMISSED FROM FURTHER CONSIDERATION

Archeological Resources/Historic Structures

There is little ground disturbing activity associated with hazard tree management actions and most activities occur within developed areas that have already been disturbed. There is little chance of encountering previously unknown archeological resources; therefore, this topic has been dismissed from further discussion.

One of the goals of the draft plan would be to protect historic structures from hazard trees and, consequently, some tree removal would occur around historic structures. During tree removal all precautions would be taken to ensure no damage occurs to historic structures. Visual impacts to historic structures or districts are unavoidable if a tree must be felled for risk reduction reasons. New trees might be planted to replace those removed. Impacts to historic structures are expected to be negligible and, therefore, the topic was dismissed from further discussion.

Cultural Landscapes

Glacier has a number of landscapes that are considered cultural landscapes. All of these landscapes are managed in a broad, all-encompassing manner that takes the entire visible landscape into account. The Going-to-the-Sun Road, with its scenic views, turnouts, vegetation, and proximity to vast wilderness areas, is a good example of a resource that is difficult to understand or manage without considering the entire landscape. The Going-to-the-Sun Road also is the only cultural landscape that has been evaluated for listing in the National Register of Historic Places. None of the other landscapes have been formally evaluated and documented in the park. Removing a small number of individual trees from dispersed areas in the park would have a negligible impact on cultural landscapes; therefore, cultural landscapes were dismissed as an impact topic. A Programmatic Agreement among the National Park Service (Glacier National Park), the Advisory Council on Historic Preservation and the Montana State Historic Preservation Officer for the Management of Historic Properties in Glacier National Park fulfills the park's Section 106 responsibilities for hazard tree removal.

Threatened and Endangered Species

There are no known locations of federally listed plant species in Glacier National Park. The federally threatened bull trout (*Salvelinus confluentus*) would not be affected by the proposed plan because no work would be conducted within waterways or have an effect on water resources. The federally threatened Canada lynx (*Lynx canadensis*) would not be affected by the proposed plan because work would not alter habitats or human-use patterns in or near areas that could potentially serve as den sites. The federally endangered (as of July 28, 2008; status pending litigation) gray wolves (*Canis lupus*) would not be affected by the proposed plan because work would occur in places frequented by humans, habitat would not be altered, and mortality risk would not increase. Therefore, these species were not evaluated in the environmental assessment.

Bull trout (Threatened)
Bull trout are located within several lakes and streams of the park. The activities outlined in the plan are not expected to impact water resources within the park. Therefore, the proposed project would have **no effect** on bull trout.

Canada lynx (Threatened)
Numerous records of Canada lynx (*Lynx canadensis*), or signs of them, exist for many areas of the park; although very little is known about the demographics and status of GNP's lynx population. Lynx habitat is generally described as Rocky Mountain Conifer Forest with a dense undercover of thickets and windfalls. Lynx generally forage in young conifer forests especially where their primary prey, snowshoe hare (*Lepus americanus*), is abundant. The common component of lynx den sites observed in other regions appears to be large amounts of woody debris and minimal human disturbance (Ruediger et al. 2000). Actions that could adversely affect lynx include elevated levels of human access into lynx habitat, human activity or noise near den sites, modification of forested habitat, expansion of the range of competitors and/or predators, or reduction of prey species populations. Actions proposed in this EA would not impact any of these factors; therefore the proposed project would have **no effect** on Canada lynx. Hazard tree treatment in the backcountry zone during the denning period (May to August) has the potential to disturb lynx at den sites; however, these effects are expected to be minimal due to the location of the activity near human-use areas (designated campgrounds and around historic structures) and the short-term nature of the activity.

Gray Wolf (Endangered)
Gray wolves are managed under the guidance of the Montana Wolf Conservation and Management Plan (MFWP 2004) as well as the protection of the Endangered Species Act. Gray wolves have been reported along every major drainage in the park during recent years including the Many Glacier, McDonald, Cut Bank, St. Mary, Belly River, North Fork, Middle Fork, and Two Medicine Valleys (NPS files). From January to December of 2006, MFWP verified four gray wolf packs occupy territories that encompass GNP (Sime et al. 2007). Wolves have continued to den in the park nearly every year since. Key components of wolf habitat are: 1) a sufficient, year-round prey base of ungulates and alternate prey; 2) suitable and somewhat secluded denning and rendezvous sites; and 3) sufficient space with minimal exposure to humans (USFWS 1987). Low elevation river bottoms that are relatively free from human influence provide important winter range for ungulates and wolves.

Wolves are especially sensitive to disturbance from humans at den and rendezvous sites. Pups are born in late March to early May and remain near the den through most of the summer (USFWS 1987). Human activity near den sites can lead to pack displacement or physiological stress perhaps resulting in reproductive failure or pup mortality (Mech et al. 1991). Rendezvous sites are resting and gathering areas occupied by wolf packs during summer and early fall after the natal den is abandoned. Indirectly, wolves support a wide variety of other species; common ravens, coyotes, wolverines, mountain lions and bears feed on the remains of animals killed by wolves. Bald and golden eagles routinely feed on the carcasses of animals killed by wolves during the winter. As apex predators, wolves also help regulate the populations of their prey ensuring healthy ecosystems and greater biodiversity (Terborgh 1988).

Museum Collections
Museum collections would not be affected by hazard tree management actions; therefore, this topic was dismissed from further discussion.

Wild and Scenic River

Tree removal could occur within the Wild and Scenic River corridor at designated campgrounds. However, the small number of trees removed in any one area would not impact the outstanding scenic values of the river that contributed to its national designation. Therefore, this topic was dismissed as an impact topic from this document.

Prime and Unique Farmlands

In August 1980, the Council on Environmental Quality (CEQ) directed that federal agencies must assess the effects of their actions on farmland soils classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) as prime or unique. Prime or unique farmland is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. According to NRCS, there are no soils in Glacier National Park classified as prime and unique farmlands. Therefore, the topic of prime and unique farmlands was dismissed as an impact topic in this document.

Socioeconomic Environment

The draft plan would neither change local and regional land use nor impact local businesses or other agencies. Therefore, the socioeconomic environment was dismissed from further consideration as an impact topic in this document.

Environmental Justice

Executive Order 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The draft plan would not have disproportionate health or environmental effects on minorities or low-income populations as all work would be conducted in the park where no minority or low-income communities have been identified. Therefore, environmental justice was dismissed as an impact topic in this document.

Soils

Hazard trees are expected to be cut above ground level and the base of the trees left in the ground. Consequently, the survey and removal of hazard trees would not involve disturbance of soils; therefore soils were dismissed as an impact topic from this document.

Water Quality and Aquatic Resources

Survey and removal of hazard trees might occur adjacent to water bodies; however water resources would only be negligibly affected temporarily from increased turbidity. Consequently, water quality and aquatic resources are not expected to be measurably affected by the proposed activities; therefore they were dismissed as an impact topic from this document. In the event that removal of a hazard tree would pose unanticipated impacts on water quality, separate environmental compliance would be conducted on a case by case basis.

Floodplains

Executive Order 11988 Floodplain Management requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The National Park Service under 2006 *Management Policies* and Director's Order 77-2 *Floodplain*

Management will strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's Order 77-2 *Floodplain Management*, certain construction within a 100-year floodplain requires preparation of a Statement of Findings for floodplains. While some of the proposed activities might occur within floodplains, the draft plan and program would not alter the function of any floodplains. Therefore a Statement of Findings for floodplains will not be prepared, and the topic of floodplains has been dismissed.

Wetlands

For regulatory purposes under the Clean Water Act, the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Executive Order 11990 *Protection of Wetlands* requires federal agencies to avoid, where possible, adversely impacting wetlands. Further, Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge or dredged or fill material or excavation within waters of the United States. National Park Service policies for wetlands as stated in 2006 *Management Policies* and Director's Order 77-1 *Wetlands Protection*, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with DO 77-1 *Wetlands Protection*, proposed actions that have the potential to adversely impact wetlands must be addressed in a Statement of Findings for wetlands. Tree removal activities are not expected to occur within wetlands; therefore, a Statement of Findings for wetlands will not be prepared, and the impact topic of wetlands has been dismissed.

Air Quality

The Clean Air Act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Glacier National Park is classified as a mandatory Class I area under the Clean Air Act, where emissions of particulate matter and sulfur dioxide are to be restricted. The act gives the federal land manager the responsibility for protecting air quality and related values (i.e., including visibility, vegetation, wildlife, soils, water quality, cultural resources, recreational resources, and public health) in Class I lands from adverse air pollution impacts; and to consider, in consultation with EPA, whether proposed industrial facilities will have an adverse impact on these values. Federal land managers are also required to determine whether existing industrial sources of air pollution must be retrofitted to reduce impacts on Class I areas.

Air quality is considered good in Glacier National Park. There are no major metropolitan areas within 125 miles of the park, and no regional smog typical of highly populated areas with a high amount of vehicle traffic. However, the cities of Columbia Falls (18 miles away), Whitefish (26 miles), and Kalispell (34 miles) all west of the park, currently do not attain national air quality standards for fine particulate matter (PM10). Consequently, Flathead County implements measures contained in a PM10 control plan to ensure ambient concentrations of PM10 do not exceed the National Ambient Air Quality Standards. Airborne particulate matter, including smoke from both natural and manmade fires and dust from unpaved roads, occasionally impairs visibility in the park.

The only pollution releasing activities associated with tree removal would be from infrequent use of chainsaws. These releases would be negligible and temporary and the pollutants would

dissipate rapidly. The Class I air quality designation would not be affected by the proposal. Therefore, air quality has been dismissed as an impact topic.

Natural Soundscapes

In accordance with 2006 *Management Policies* (NPS 2006a) and Director's Order 47 *Sound Preservation and Noise Management*, an important component of the National Park Service's mission is the preservation of natural soundscapes associated with national park units. Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among National Park Service units as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

Survey and removal of hazard trees would involve a minimal amount of noise created by human presence and infrequent use of chain saws and other tools in all the management zones. The effect on natural soundscapes is expected to be temporary and negligible; therefore natural soundscapes were dismissed as an impact topic from this document.

Park Operations

Survey and removal of hazard trees in the backcountry zone represents only a slight change from the current operations; therefore park operations was dismissed as an impact topic from this EA.

Visitor Experience

The noise associated with infrequent use of chainsaw use, especially in the backcountry zone, would impact visitors present in those areas; however, it is of short duration and only used in accordance with a minimum requirement/minimum tool analysis. Removal of hazard trees that might contribute to scenic views would have a negligible effect on visitor experience in the park. There would be beneficial impacts to visitor safety, through risk reduction, and this is addressed under Public Health and Safety. Impacts to visitor experience would be negligible; therefore, it was dismissed as an impact topic from this document.

ALTERNATIVES CONSIDERED

NO ACTION ALTERNATIVE

The No Action Alternative would continue hazard tree management as outlined in the 1994 *Hazard Tree Management Plan*. It includes most of the guidelines described below in the Preferred Alternative. Management zones would be based upon outdated categories of "developed", "historic", "special use", and "natural" zones. These zones are no longer used and were replaced with new zones described in the 1999 *General Management Plan*. Hazard tree management would primarily remain the responsibility of the Hazard Tree Crew in all management zones. Though hazard trees would continue to be felled in the backcountry zone, clear management guidelines do not currently exist. The 1994 plan also does not provide guidelines for monitoring, the disposition of downed trees, or mitigation for loss of trees.

PREFERRED ALTERNATIVE (*HAZARD TREE MANAGEMENT PLAN*)

The Preferred Alternative is to implement a new *Hazard Tree Management Plan (in draft form)* as outlined below. This plan is based upon the 1994 *Plan* with changes management of the backcountry zone and in organizational roles and responsibilities. This alternative also sets priorities based upon the management zones developed in the *General Management Plan* (NPS 1999a) including the visitor service zone, rustic zone, day use zone, and backcountry zone. Monitoring of sites and planting of young trees as mitigation are discussed in more detail in the new plan than in the old plan.

Table 1 describes the differences between the 1994 plan (No Action Alternative) and the new plan (Preferred Alternative).

Table 1. Extent that Each Alternative Meets the Project Objectives and Sub-objectives

Objective	No Action Alternative	Preferred Alternative
Assure park-wide consistency and continuity in hazard tree surveys, ratings, documentation, and evaluation of management alternatives.		
Clarify management zones used for setting priorities	Identifies "developed", "historic", "special use", and "natural" zones. These are not the currently used zones defined in the 1999 *General Management Plan*.	Sets priorities according to the management zones identified in the 1999 *General Management Plan* (visitor service, rustic, day use, and backcountry zones).
Clarify responsibility of hazard tree management along road corridors	Hazard tree management is primarily the responsibility of the Hazard Tree Crew in all areas.	Within developed areas, in all areas away from roads hazard tree surveys would be conducted by the Hazard Tree Crew (IPM crew). Treatment actions would be implemented by qualified park staff. Along roads outside of developed areas hazard tree management would be the responsibility of the Division of Facility Management. Trees along trails, roads, bike paths, undeveloped areas, or off-trail areas would not be subjected to hazard tree management.
Clarify locations and responsibilities for cutting trees in the backcountry zone	Does not address the cutting of trees in the backcountry zone.	Surveys and treatment actions would be conducted in developed areas such as campgrounds and around historic cabins in the backcountry zone.

Objective	No Action Alternative	Preferred Alternative
Implementation of a systematic, yet ecologically sound, program that provides regular prioritized surveys, evaluation of potentially hazardous trees, and treatment.		
Clarify the type of hazard tree monitoring to be conducted	Does not specifically address.	Monitoring would be implemented to determine success of young replacement tree plantings and to determine extent of disease and/or insect infestation within concentrated areas.
Preservation of ecosystem dynamics and structure, particularly the age classes and species diversity, while reducing hazards.		
Clarify the procedures for dealing with downed trees	Does not address this issue.	Describes four options for leaving or disposing of the tree.
Implement guidelines for planting young trees as mitigation for tree removal	Does not address the planting of young trees as mitigation.	Encourages the planting of young trees in areas where the cumulative effects of hazard tree removal have resulted in a noticeable reduction in the overstory.

Glacier National Park's Draft Hazard Tree Management Plan

I. INTRODUCTION

Approximately 57% of Glacier National Park is forested. Numerous public facilities and roads as well as a small number of private homes are situated within these forests. Visitation continues to increase with around two million visitors using the park's roads and facilities each year. The potential exists for weakened trees or portions of trees to fall and cause damage stationary targets. Park management has a responsibility to reasonably protect visitors from unnecessary risks resulting from hazardous trees.

Even though any tree or portion of a tree might 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 significant flaw or structural defect might be deemed hazardous. A hazard tree is any tree that contains a significant defect and is likely to impact a target. A structural defect is defined as any outwardly visible physical manifestation of structural unsoundness or indication of rot such as girdling, large surface wounds, beetle infestation, or significant root exposure. A target would be an area where a person might be stationary and stationary objects, structures, or vehicles.

The purpose of Glacier National Park's Hazard Tree Management Program is to reduce the risk to stationary targets in developed areas in the front country, in designated backcountry campgrounds, and around historic backcountry cabins that are near or surrounded by trees from identified hazard trees while protecting ecosystem integrity. This draft plan provides the guidelines to identify and assess what represents a hazard tree and identifies a range of management actions to select from to reduce the hazard while considering ecological concerns. While most hazard tree work takes place in the visitor service zone, some structures and designated campgrounds in the backcountry zone require protection from damage caused by hazard trees. The draft HTMP also would assign responsibilities for carrying out the program. The Hazard Tree Program Manager (Program Manager) would be a Supervisory Biologist (currently the Integrated Pest Management [IPM] Biologist) who works in close coordination with a park Ecologist, Wildlife Biologist, and Facility Managers. The Program Manager would direct and supervise the field crew who would conduct surveys and treatment actions. At this time the Hazard Tree Program is primarily implemented by the park's Integrated Pest Management (IPM) crew. The crew is responsible for conducting the surveys and, when time and money allow, the treatment actions. Other park crews with available trained and certified staff would assist with treatment actions. The crew would also be responsible to perform a minimum requirement/minimum tool analysis (see Section 6) for hazard tree treatment actions in recommended wilderness areas around designated campgrounds and historic structures.

The objectives of the Hazard Tree Management Program are as follows with their associated sub-objectives that would better achieve the objectives:

- Assure park-wide consistency and continuity in hazard tree surveys, ratings, documentation, and evaluation of management alternatives.
    - Clarify management zones used for setting priorities
    - Clarify responsibility of hazard tree management along road corridors

    - Clarify locations and responsibilities for cutting trees in the backcountry management zone
- Implementation of a systematic, yet ecologically sound, program that provides regular prioritized surveys, evaluation of potentially hazardous trees, and treatment.
    - Clarify the type of hazard tree monitoring to be conducted
- Preservation of ecosystem dynamics and structure, particularly the age classes and species diversity, while reducing hazards.
    - Clarify the procedures for dealing with downed trees
    - Implement guidelines for planting young trees as mitigation for tree removal

A hazard tree exists when a tree or portion of a tree is in imminent danger of falling, due to disease or structural failure, and striking a stationary target. Not all trees with diseases or structural defects are hazardous, only those that are significantly weakened and present an unnecessary risk to stationary target. Trees not in developed areas, backcountry campgrounds, and around historic backcountry cabins regardless of their condition, do not have the potential to become hazards because there is no target. Trees along trails, roads, bike paths, undeveloped areas, or off-trail areas would not be subjected to hazard tree management because people are generally moving when using trails, roads, and paths so there is no stationary target that hazard trees would present a danger to.

Hazard tree management would occur around stationary targets which could include areas where the park actively encourages the congregation of people or their property such as designated campgrounds, parking areas, maintained and historic structures, trailheads, docks, corrals, picnic areas, and turnouts in all management zones.

Trees with no detectable defects might fall during extreme wind events or due to unknown causes. The only way to eliminate all probability of damage by trees would be to fell all trees within human-use areas. This clearly counters the park's mandates as it would decrease the quality of visitor experiences and would have detrimental effects on cultural and natural resources.

II. AUTHORIZATION

The enabling legislation for the park as well as the Organic Act of the National Park Service mandates the preservation of the biological and historical diversity in the park, while providing for enjoyment by park visitors.

NPS *Management Policies* (2006) and the NPS #77: *Natural Resource Protection, Chapter 2* provide the authority to conduct hazard tree assessment and treatment activities in the park. There are multiple other sections of Management Policies 2006 that are relevant to the hazard tree management plan. These sections include, but are not limited to, the following: Section 4.4.2.3 Management of Threatened or Endangered Plants and Animals, 4.4.2.4 Management of Natural Landscapes. 4.4.1.2 Genetic Resource Management Principles, 5.3.1 Protection and Preservation of Cultural Resources, 5.3.5.1.1 Preservation of Archaeological Resources, 5.3.5.2 Cultural Landscapes, 6 Wilderness Preservation and Management, 8.2.5.1 Visitor Safety, 8.2.2.1 Management of Recreational Use.

III. COMPLIANCE

The Plan/Environmental Assessment analyzes impacts of implementing the hazard tree management plan. If special concerns about a hazard tree activity are raised, that have not been analyzed in this EA, individual compliance documents might need to be prepared prior to

treatment of the tree. Special concerns may include rare and endangered species or their critical habitat not yet identified, impacts to visual resources or cultural landscape values, impacts to soils and hydrology, substantial alteration of local natural forest structure and composition, wildlife nesting or breeding periods, surface disturbance of archaeological sites, public health and safety, and/or cumulative effects of ongoing programs or extended projects. It would be the responsibility of the Hazard Tree Program Manager, and or staff planning to conduct treatment and the Environmental Compliance Specialist to determine when additional compliance would be necessary.

Additional compliance would be mandatory for certain actions that include:

1. Closure of facilities permanently or for an extended period of time. This might result from inability to mitigate the hazard or move the facility or temporary wildlife activity such as nesting birds.
2. Relocation of a target requiring extensive cost and/or planning (e.g. parking lot, campground, etc.).
3. Removal of trees when such removal results in a 10% or more loss of standing trees within the immediate environment (based on Park personnel's professional experience).
4. Removal of known protected species perch or nesting trees.
5. Culturally scarred trees that become hazard trees and require treatment.

Absent these conditions, (1-5) treatment actions might proceed with the approval of the Program Manager.

IV. PROCEDURES FOR OPERATIONS

The procedures for treating hazard trees involve seven steps; (A)Setting Priorities, (B) Conducting Surveys to Identify Hazard Trees, (C) Implement Mitigation Measures, (D) Select Treatment Actions, (E) Implement Treatment Action, (F) Conduct Tree Disposal, site rehabilitation and Monitoring and (G) Document Work. These are described below in more detail.

Sections 1-6 describe the (1) hazard tree management decision tree process, (2) tree rating criteria, (3) determination of probability of tree hitting a target,(4) survey forms, (5) common hazards of tree species found in Glacier National Park, and (6) the Minimum Tool/Minimum Requirement Analysis.

It is also necessary for the Hazard Tree Program Manager to work closely with the staff to ensure strategies are implemented as intended.

A. Set Priorities

The goals, objectives, and activities for each year would be prioritized by the Program Manager based on funding, capabilities, concerns voiced by other staff, and the previous years' ecological evaluation.

The Program Manager would lead the annual implementation of the Hazard Tree Plan, which would include:

- Approved treatment actions from previous exams.
- Trees that need to be re-examined.
- Identification of areas for spring surveys.

- Vegetation rehabilitation actions that are scheduled.
- Assignment of responsibilities and schedule for work accomplishment.
- Identification of informational needs.
- Monitoring needs as identified in exams.
- Minimum Requirement/Minimum Tool analysis for removal within recommended wilderness.

Considerations to use in setting priorities would be based on management zones from the *General Management Plan* (1999a). Within each zone are areas such as campgrounds that have specific stationary targets.

Priority 1: Visitor Service Zone.

This zone includes developed areas, paved roads, and campgrounds with potable water and sanitation facilities. Surveys to identify hazard trees would be conducted annually in the spring, before facilities open. Visitors and employees most frequently use this zone, therefore the visitor service zone has highest identification rate of hazard trees. The park has encouraged visitors to use and remain in these areas for travel, services, lodging, and recreation with a reasonable expectation of safety. Most visitor facilities are campgrounds, visitor centers, lodging facilities, designated parking areas, and housing areas.

Priority 2: Rustic Zone and Day Use Zone.

The rustic zone includes primitive facilities and campgrounds representative of the early western national park development and traditional visitor experiences in them. Some of the historic buildings in this zone might be irreplaceable structures, such as cabins and old homesteads. The day use zone includes selected areas with specific destinations that visitors can reach easily within a day from visitor use zones

Priority 3: Backcountry Zone.

More than ninety-five percent of the park is located within this zone which also includes the park's entire recommended wilderness. There are historic structures and designated campgrounds in the backcountry zone which require protection from hazard trees. Hazard tree surveys would be conducted by sub-district backcountry staff in areas of concentrated visitor use including designated campsites, and the associated food preparation areas, pit toilets, hitch rails, and historic cabins. Survey results and photos would be shared with the Hazard Tree Program Manager and if necessary, treatment strategies would be considered and implemented. Trees that are felled would be left on site but out of the way of campgrounds, trails, or structures. A minimum requirement/minimum tool analysis would be conducted to determine the appropriate tool to fell the identified hazard tree(s). Possible tools include pushing the tree over, winch, handsaw, explosive or chainsaw use. In the backcountry zone, particular consideration would be given to the option of moving a target such as a campsite or pit toilet, especially if the tree is an important wildlife tree.

Note: Non-Park Lands Within the Park Boundary.

This area includes lands such as utility corridors, private lands and other types of land ownership and leases. The park would usually not conduct surveys or take treatment action on these lands unless the park was requested to assist as a consultant or if the hazard tree has the potential to fall onto a target in the park. The landowner has primary responsibility for treatment of the hazard. If the tree(s) or branch(s) is on Park land and threatens private structures or utilities, the park would implement the *Hazard Tree Management Plan*.

B. Surveys to Identify Hazard Trees

There are two types of surveys used to identify hazard trees:

1. Surveillance surveys provide general oversight by walking or driving through an area and visually scanning to detect potentially hazardous trees. Surveillance might be part of a regular yearly work program, a normal part of spring opening, or occur after some wind events or snowstorms. Species, size, and suspected cause of failure are noted. Reports of potentially hazardous trees are reported to the Hazard Tree Program Manager by any park employee, concession employee, visitor, or in holder.

The following types of inspection would be used when conducting surveillance surveys:

- *Drive-by or windshield survey*. This type of survey involves deliberate visual scans at slow vehicle speed followed by more detailed inspections mentioned above for all trees noted or suspected of possessing hazardous characteristics.
- *Walk Through*. This is a walk through of the area visually scanning for potential flaws. This includes inspection of individual trees suspected of being hazardous, as defined above.
- *Individual Trees*. Each tree with an identifiable defect would receive a 360 degree visual inspection. This means close visual inspection, including tests with various tools as warranted. Use of binoculars, hammers, coring devices (increment borer), and other tools can be used to enhance the quality of the inspection process when necessary. When using an increment borer, do not bore into the tree more than what is necessary to determine minimum thickness of sound wood (see Section 2 - Table 4). Increment borers would be disinfected after each use.

2. Examination surveys would be conducted by trained IPM crew members under the direction of the Program Manager. They would be done concurrently or as soon after a surveillance inspection as possible. Examinations would be systematic, specimen by specimen evaluations of all potentially hazardous trees identified in the Surveillance Reports. The purpose of examination surveys is to make a risk assessment of detectable hazard trees. The examination and rating include species identification, description, measurement, defect assessment, wildlife use, hazard rating, documentation of location, recommended mitigation and date mitigation would occur. The examiner might choose to rate the hazardous portion of the tree, rather than the whole tree (i.e., dead top or branches).

The hazard tree rating system would be used to evaluate potentially hazardous tree conditions, and provide a guide for making decisions on treatment methods. It is an assessment of risk that considers the probability of damage to a target. It also takes into account the target value. The hazard rating system is comprised of analysis of these factors, which are added as points recorded on the Hazard Tree Examination Form (Section 4), and kept on file in the Program Manager's office. Based on the examination survey, interim warnings or closures might be put into effect.

Each tree would be carefully surveyed for presence of defects (see Section 5). The following list includes many of the most common types of hazardous tree conditions to look for:

- Decay
- Cavities
- Dead Limbs (overhangs)

- Splints and shakes
- Weak Crotches
- Heavy horizontal limbs
- Basal or crown rot; root decay
- Carpenter ant infestations
- Wind or vehicle damage
- Construction damage
- Leaning trees; heaving
- Tree failure due to insect pest and disease situations.
- Heavily used areas with compacted soil and injured roots.

This list is not meant to be inclusive of all potential hazardous tree conditions but to provide guidance for what defects might be present.

Trees with defects would be rated no, low, medium, high, or very high (0-4) as to the likelihood of their failure during the current season (USDI 1991). An extra point might be added if a tree exhibits other defects in addition to structural problems (i.e. lean). Trees with no defects would automatically fall into the no hazard category. If a tree has fallen, the suspected cause of the fall as well as any defects would be noted. Documentation on species, size, any defects present, and cause of failure or date of removal would be maintained on each tree. The potential impact to the target would also be rated low, medium, or high (1-3) according to the value of the structure and/or human use levels and the probability of hitting a target. Basic tree failure ratings are included here with more detailed guidelines in Section 2 (modified from Wallis et al. 1980).

Tree Failure Potential

A tree would be rated as to its potential for failure as follows:

0 – minimal potential for failure, no defects present

1 – low potential for failure, some defects present

2 – medium potential for failure, moderate defects present

3 – high potential for failure; dead trees, trees with serious defects, and those with multiple defects

4 – very high potential for failure, a tree with several serious defects and a lean resulting from causes other than natural growth

Impact to Target

This rating considers the potential impact to a stationary target if a tree were to fall on it. Included in this rating is the size of the tree or parts thereof, the probability of it hitting a target (Section 4), and the value of the target and/or human use levels.

1 – Minimal damage potential; the probability of hitting the target is low, the tree or parts thereof that could fail are small, the target is of low value, there is infrequent human use of the target.

2 – Moderate damage potential; there is a medium probability of hitting the target, the tree or parts that could fail are of sufficient size to cause moderate damage, the target could sustain some damage or is of moderate value, there is moderate human use of the target.

3 – Extensive damage potential; the probability of hitting the target is high, the tree or parts that could fail are of sufficient size to cause extensive damage, the target is of high value, there is frequent human use of the target.

In some instances, there might be conflicts in the potential rating. For example, a tree has a high probability of hitting the target, but the target is of low value and infrequently used and the parts of the tree that could strike the target are of moderate size. The examiner must balance the various issues to determine a rating. In the above case, the rating would be a 1 or 2 depending on the actual value and purpose of the target.

Overall Hazard Tree Rating

The two ratings are added together to obtain an overall rating to determine hazard level and management action according to the following chart. Hazard determination and recommended action (modified from NPS-77, USDI 1991; Section 3).

Table 2. Hazard tree ratings.

Rating	Hazardous Condition	Recommended Action
0	No discernible flaw and no construed risk- not a hazard.	No immediate action needed.
1-2	Low – not a hazard.	No immediate action needed.
3-4	Medium – not a hazard.	Monitor annually or as recommended, but do not remove, or mitigate.
5-7	High – hazard.	Top or fell the tree or defective limb(s) or move target, or close the site.

Treatment actions would be prioritized based on hazard rating. For example, actions would be implemented on trees with a 7 rating before trees with a 5 rating. Trees that are not hazards (i.e. those with no defects or with defects but not likely to fall) should be monitored annually in high use areas and less frequently in lower use areas to detect any changes in their condition that might change their status to a hazard.

C. Mitigation Measures

The following mitigation measures would be implemented to minimize the degree and/or severity of adverse effects of hazard tree management as appropriate.

- Removal of hazard trees with active nests might be delayed until after the nesting season.
- Number of hazard trees recommended for felling would be compared to the number of trees felled in previous years within the area to maintain the natural structure of the stand.
- Chainsaw restrictions would be in place at a few lakes when nests are occupied.
- Any hazard trees identified as "wildlife trees" and requiring removal would not be cut until the fall to avoid potential impacts on breeding species that might be using the tree.
- The park would begin collecting additional information during hazard tree examinations. For trees within 300 feet of a lakeshore, the distance to the shore would be recorded as would the tree's status as a bald eagle perch tree (after consultation with a Wildlife Biologist).
- Chainsaws would not be used within a ½ mile of a bald eagle nest prior to July 15.

- The park would plant two young trees, of the same species and in the same general vicinity, for all trees removed for hazard tree purposes. The trees would be grown from seeds collected in the park and raised in the park's native plant nursery. Records would be kept on the species, tree age, and location of all newly planted trees and monitoring would be performed to determine their survival rate.
- Periodically, hazard tree data, including planting records, would be reviewed to re-assess the potential cumulative impacts of the program on perch trees and lakeshore tree recruitment.
- The park plant ecologist would provide a map of rare plant locations to the hazard tree program manager prior to the start of cutting activities each year.

D. Select Treatment Action

The Program Manager would use the Decision Tree (Section 1) to select which management action to implement to reduce the risk from trees judged hazardous during the examinations. He/she is ultimately responsible for selection of a preferred treatment or obtain a staff decision when necessary (see below). Selection of a treatment action considers the prescribed criteria and coordination/consultation with park staff.

Trees that are not hazards (i.e. trees with defects but not in immediate danger of falling and striking a target) are monitored to detect changes in their condition. Trees that are judged to be hazardous require treatment as soon as possible following the examination. Areas within striking distance of an imminent hazard tree would be signed and closed to the public until full consideration of possible actions and removal of the hazardous conditions is completed.

There are three treatment actions that would be considered to eliminate the hazard from trees:

1. the tree might be felled
2. the target might be moved, or the area closed to human use
3. the hazardous portion of the tree might be detached

Treatment actions would consider:

1. Aesthetic, historic, and cultural value of the tree.
2. Ecological value of the tree including wildlife forage and nesting, vegetation community dynamics (shading, seed source, etc.), and potential for windthrow following felling. Removal of trees with active nests might be delayed until after the nesting season.
3. Number of trees recommended for felling and number of trees felled in previous years within the area.
4. Forest community, site conditions, susceptibility of site to having hazard trees, and species of trees.
5. Historic, social, and monetary value of the target.
6. Feasibility of closing the area or moving the target.
7. Management zone and the type and amount of visitor use in the area.

All reasoning for the final management decision would be well documented on a tree rating form (exam record).

E. Implement Action

If a decision is made to treat hazard trees (see Section 1), all provisions for public risk reduction, crew safety, sawyer skill level, and the removal of debris must be met. Cutting and felling of the tree and cleanup is coordinated by the IPM crew with other divisions as necessary. The Program Manager would be responsible for timely implementation of the selected action, and coordination with other activities such as campground opening and facility maintenance.

If the decision is made to fell a hazard tree in the backcountry zone a *Minimum Requirement/Minimum Tool* analysis would be completed prior to implementation (see Section 6). Tools used for treatment of hazard tree might include manually pushing the tree over, a winch, a handsaw, explosives, and a chainsaw. This analysis would determine the appropriate tool to fell or mitigate a hazard tree in and around designated campgrounds and historic structures in the park's recommended wilderness.

Any hazard trees identified as "wildlife trees" and requiring removal would not be felled until the fall to avoid potential impacts on breeding species that might be using the tree. Chainsaws would not be used within a ½ mile of a bald eagle nest prior to July 15. Depending on the location of the tree and its integrity, the park might consider leaving the main trunk of the tree for wildlife habitat in areas where wildlife is considered an important element.

The number of trees felled each year might vary depending on budgetary and personnel constraints. Contract and cyclic maintenance funds might be requested for the removal of trees. A list of qualified sawyers from all divisions is maintained by the Hazard Tree Program Manager to utilize for tree removal throughout the park.

When high winds or other conditions increase visitor risks due to hazards posed by falling trees or limbs, protection actions such as road, site or campground closures, and the evacuation of visitors to secure areas might need to be taken. Closures and evacuation are addressed in the Emergency Evacuation Plan and are the responsibility of the District Rangers. Developed sites might be closed temporarily following severe wind storms until adequate surveys can be completed and treatment actions carried out if necessary.

Temporary site closures are coordinated by the District Ranger. Seasonal or permanent site closures and/or moving of facilities are reviewed and approved by the management staff.

F. Tree Disposal, Site Rehabilitation, and Monitoring

Once a hazard tree has been felled, a decision would be made as to the fate of the downed tree. This decision would be based upon the size and species of tree, the management zone, the location within the management zone (e.g., campground, trail, parking lot), and the capability to move the tree. The following options would be considered:

1. Leave the tree – This is the primary choice in the backcountry zone and should be the first consideration in all instances. Decaying logs recycle nutrients back into the soil, provide wildlife habitat, and create microsites essential for plant recruitment. Some trees might require relocation to remove them from a trail or other use area. Partial removal of limbs or other debris, particularly in fuel reduction areas might also be considered.
2. Salvage for facility restoration activities – Historic restoration of park structures can often use logs if they are in a sufficiently sound condition and they can be moved.
3. Auction as firewood - If a large enough quantity is acquired, it can be sold at auction and the funds used within the park.
4. Burn at the dump – This would be a last resort.

One of the ecological concerns with any tree removal program is the disruption of the natural community structure. In many cases, tree hazards occur in a well-developed forest with canopy and understory vegetation. Removal of a few hazard trees would not be a substantial disruption to the natural community. However, some sites suffer from heavy use which precludes development of understory vegetation (e.g. Lake McDonald Lodge developed area and Avalanche Campground). As trees die and/or are removed, there are no young trees to replace them. Eventually, the area does not have any overstory and is converted from a forest to an open grassland, shrub, or barren area. In areas where there is no overstory, a rehabilitation plan would be developed which compensates for the long-term impacts of hazard tree removal.

In places where many older trees have been removed or topped an emphasis would be placed upon recruitment of young trees. The park would plant two tree seedlings, of the same species and in the same general vicinity, for every tree removed for hazard tree purposes, when appropriate seedlings are available. The trees would be grown from seeds collected in the park and raised in the park's native plant nursery. However, in areas where disease is the primary cause of tree mortality, new trees might become just as susceptible to becoming hazard trees. Therefore, consideration would be given to the species to be planted, and replacing removed trees with the same species might not always be appropriate. Trees would be planted in coordination with the park's Revegetation Crew. Records would be kept on the species, tree age, and location of all newly planted trees and monitoring would be performed to determine their survival rate. Periodically, hazard tree data, including planting records, would be reviewed to re-assess the potential cumulative impacts of the program, especially on perch trees and lakeshore tree recruitment. Additionally, an assessment of the accuracy and reliability of the tree rating and rating criteria is conducted as funding becomes available. Reviews are conducted by the Program Manager and Ecologist.

Monitoring would be conducted in areas with an observed insect or disease infestation within a concentrated area. Monitoring would also be done on trees that have been recently planted to determine success. Monitoring is also an action item from the Survey Forms. Trees that have signs of weakness or predation but have no indication of eminent failure are monitored in future years.

G. Document Work

Documentation is essential for any resource decision or manipulation. Additionally, detailed documentation assists in analyzing and improving the program. Potential hazard trees are tracked in a computer database. The following documentation would continue to be maintained for the hazard tree management program. Please refer to Section 4.

1. Trees identified during surveys would be recorded on the "Hazard Tree Surveillance Record" form. Information in reports includes tree location, description of defect, species, estimated height and width, description of target and action recommended. These reports are submitted to the Program Manager for evaluation. Potential hazard trees might also be recorded on maps of the developed area, with supporting information.

2. Examination Surveys would be recorded on the "Hazard Tree Examination Record" form. The form includes documentation of detailed inspections, results of criteria rating, decision on treatment and date of implemented treatment. Information would also be recorded regarding the tree's status as a bald eagle perch tree and the trees distance to the lakeshore, if within 300 feet of the lakeshore. The treatment action is not implemented until information from the inspection is completed.

3. Training courses and seminars are documented and recorded on a training form for the employees personnel file.

4. All tree records would be maintained in a computer database, updated each fall. The database would be used to track trees for monitoring and treatment efforts and make ecological evaluations of the program. The Program Manager working with the Computer Specialist would design and manage the database.

V. STAFF AND PUBLIC INFORMATION

It is important to communicate the goals and provisions of this plan to the staff through training programs, notices, and individual contacts. This is especially important when removal projects are imminent or underway. It is critical to inform the interpretive staff, the Public Information officer, and other ranger and maintenance personnel who are working in or near the affected area.

The public would be informed where treatment actions are occurring that might affect their activity planning. If tree removal is planned within facilities that are open, adequate information is provided before actions are implemented. Larger projects that could be controversial would undergo further environmental analysis, compliance documentation and potential public review.

VI. SAFETY

Safety of personnel is of the highest concern in all hazard tree management operations. Training and certification for skills would be based on safety concerns. The following is a list of requisite, specific safety rules that would be followed by anyone conducting hazard tree management operations in Glacier National Park.

1. Treatment operations would periodically begin with a documented safety session including a review of the applicable Job Hazard Analyses:
    a. Hazard Tree JHA
    b. Backcountry Field Work JHA
    c. Vehicle Operation JHA
    d. Chainsaw JHA
2. All blasting operations would comply with NPS *Director's Order #65: Explosives Use and Blasting Safety*, which includes all safety, training and certification requirements prior and during blasting operations. In cases where it has been decided to use explosives to remove a hazard tree, the crew would consult with park's Chief Park Blaster.

VII. ROLES AND RESPONSIBILITIES

A. Division of Science and Resources Management

1. A Supervisory Biologist (currently the IPM Biologist) is the Hazard Tree Program Manager. He/she would consult regularly with park staff composed of District/Subdistrict Rangers, Facility Managers, and Biologists to determine work priorities. The Hazard Tree Program Manager would also: assist with public information, coordinates supervision of surveillance and

examination surveys, determine treatment actions, assesses personnel qualification levels for surveys and tree removal, coordinate training, review effectiveness of the *Hazard Tree Management Plan*, and manage a seasonal field crew. This would includes ecological evaluation of work completed to determine long-term impacts, development and evaluation of rating criteria, modification of treatment selection factors, and development of a computer database.

2. The field crew (IPM crew) would be a seasonal crew led by a field leader with experience and training in tree removal techniques. The field crew conducts surveys and implements treatment actions. The IPM crew would work cooperatively with ranger, fire, trails, and maintenance staff to coordinate tree removals. Any tree planting conducted after hazard tree treatment would be coordinated with the park's Revegetation Program.

3. A Plant Ecologist and Wildlife Biologist would be consulted on a regular basis regarding the removal of mature trees, potential "wildlife trees", and for areas where multiple large trees might need removal.

4. The Cultural Resource Specialist would be consulted when multiple trees within a Historic District are identified for treatment and could result in a considerable change in the appearance of the district or to determine if a culturally scarred tree is present.

B. Division of Visitor and Resource Protection

1. District and Subdistrict Rangers might recommend priorities for surveys and treatment in their areas. Subdistrict personnel might assist the Hazard Tree Program with implementation efforts, as assigned by the District Ranger. Duties might include surveillance, felling trees, or cleanup. District personnel would be responsible for informing visitors of significant weather events that could increase the hazard from trees and posting notices or signs and implementing the Emergency Evacuation Plan when needed.

2. Backcountry staff might conduct surveys and treatment at designated campsites and developed facilities within the backcountry and day use zones. All work would be coordinated with the Hazard Tree Program Manager.

3. Trail Foremen and crews might assist with surveys and treatment within the backcountry and day use zones. They might be requested to assist with hazard tree treatments within developed areas.

4. Fire crews might assist with falling or area clean-up.

C. Division of Facility Management

1. Facility managers participate by suggesting priorities and determining the level of assistance that can be provided.

2. Road Maintenance crews are responsible for surveying and removing approved hazard trees from all road corridors. This work would be done in accordance with the *Hazard Tree Management Plan* and in coordination with the Program Manager as discussed in the *Road Maintenance Guidelines* (NPS 2005). Hazard trees located along roads do not constantly threaten a stationary target and therefore require less scrutiny. Trees that typically occur along park roadways, pullouts, and parking areas would be periodically inspected during drive-by windshield surveys. These surveys would look for trees with obvious or imminent defects and a definite lean into the road.

3. Maintenance crews might be asked to assist with cleanup efforts following hazard tree treatment actions.

D. Division of Interpretation and Education

1. Interpreters might submit informal reports of potentially hazardous trees to the Hazard Tree Program Manager whenever they observe a tree that might be a hazard. They provide interpretation of hazard tree removal as necessary within campgrounds and developed areas.

E. Division of Concession Management

1. The concessions management specialist would provide assistance in implementing this plan with the concessioners in the Park.

F. Safety Officer

1. Hazard trees might be reported to the Safety Officer by any employee in a given area using the Hazard Condition Report. This record would be maintained by the Safety Officer who would work cooperatively with the Hazard Tree Program Manager for implementation. The Safety Officer is a technical consultant regarding risk reduction issues.

G. Training for All Program Employees

1. It is critical for employees involved in the Hazard Tree Management Program to have training in particular skill areas related to specific tasks. For surveillance, and particularly examination surveys, the following skill areas and types of training would be important:

a) Basic silvicultural and vegetation management principles; ecological relationships linking vegetation, insects and disease; arboricultural techniques and equipment; basic training in botany, dendrology, and/or plant pathology; Glacier National Park forest ecology and habitat types.

b) Attendance at a Tree Hazard Identification training course to train personnel to identify/evaluate tree defects, use the rating system, and recommend treatment action; development and use of a detailed defect/hazard diagnostic key.

c) Attendance at arboriculture workshops where tree care, hazard treatment procedures, and equipment use are taught; pest management seminars including insect and disease identification.

d) A Wildlife Biologist would annually provide training in how to recognize a tree that might be frequently used by wildlife, including bald eagle perch trees.

e) Knowledge of how to recognize a culturally-scarred tree and other vulnerable cultural resources.

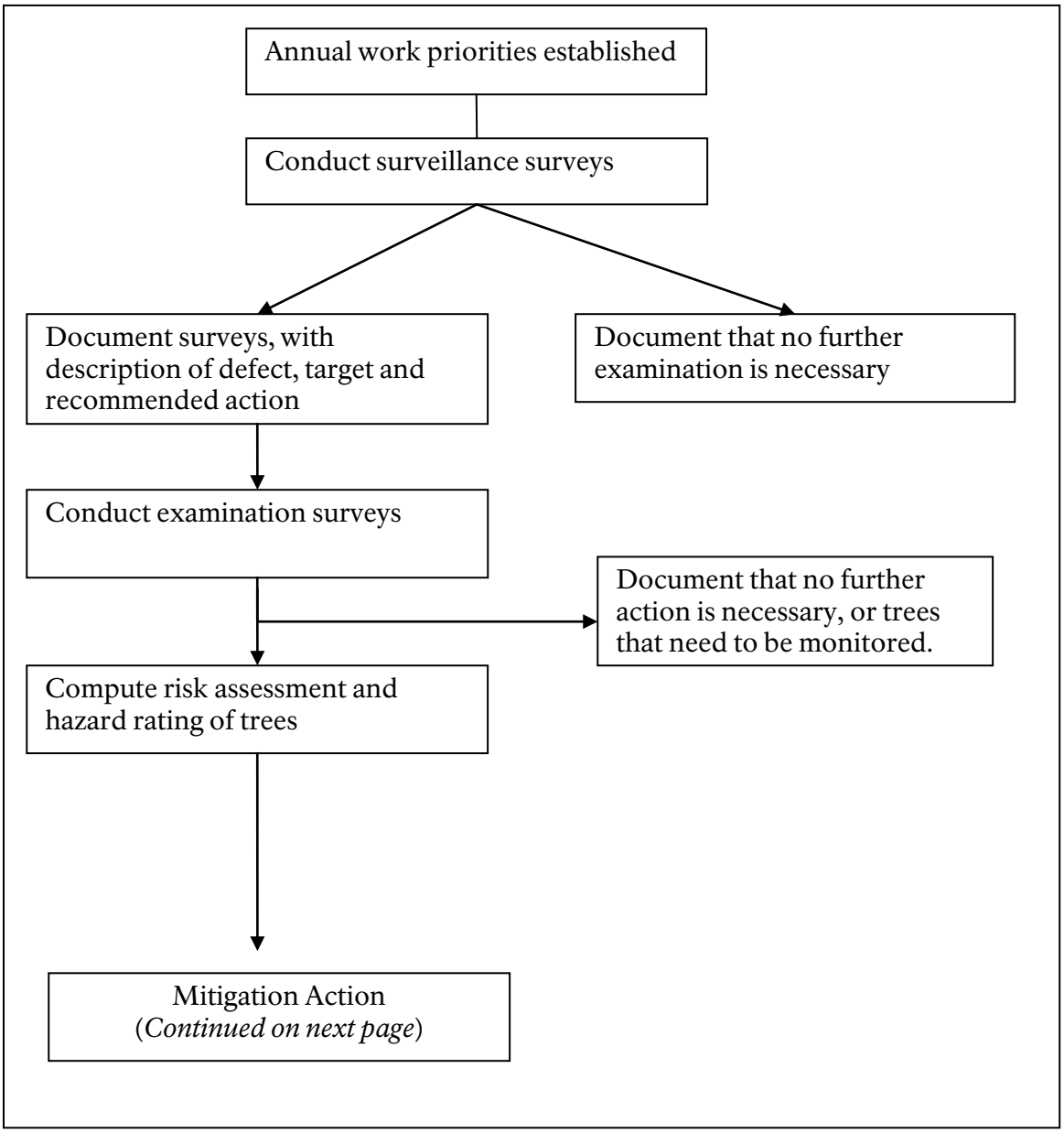
2. For employees involved in removal or limbing:

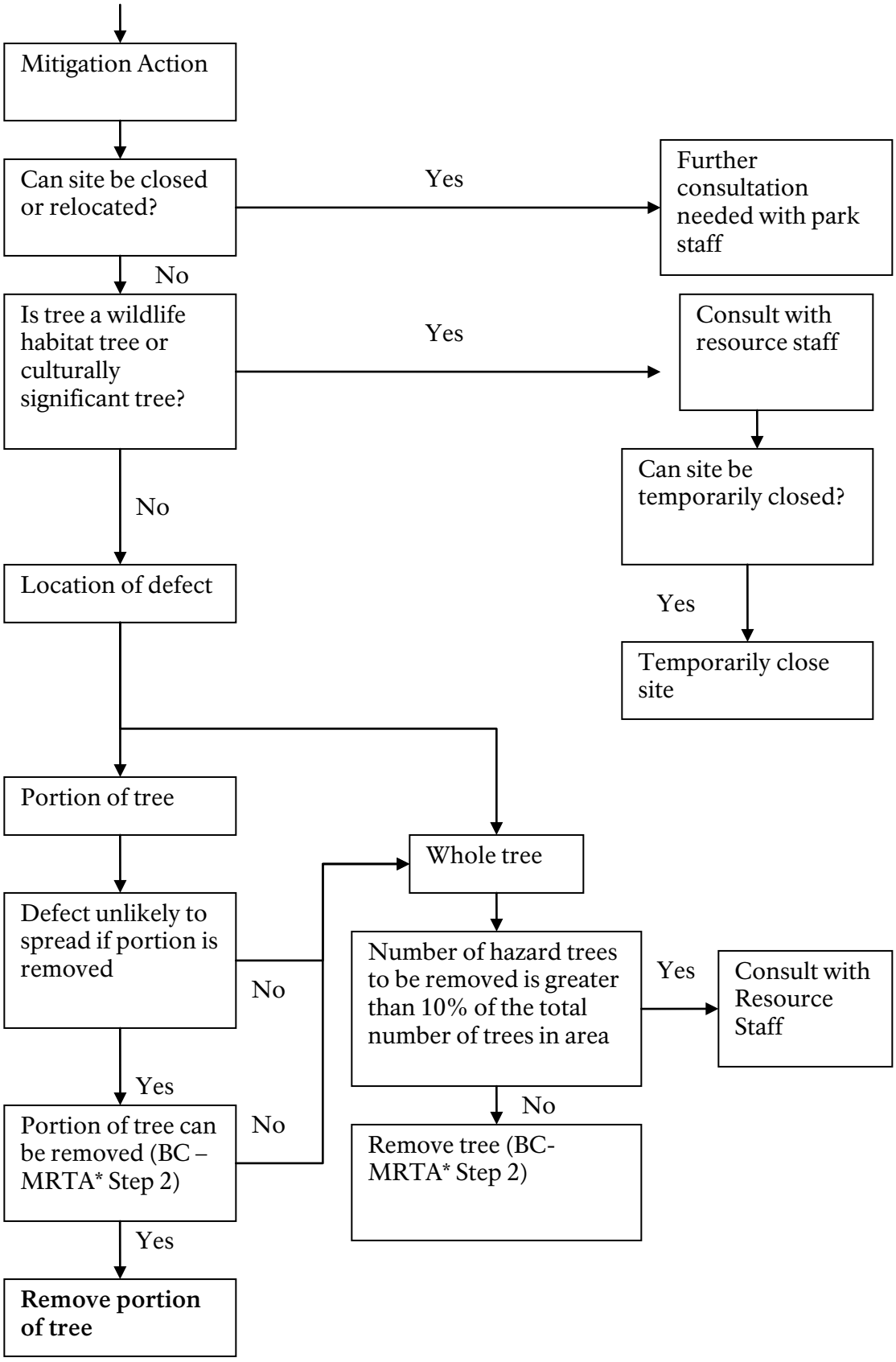
a) Technical training in chainsaw operations, including felling techniques and equipment maintenance; certification is required for chainsaw operators and fellers in accordance to Glacier's Safety Manual Procedure 7-1 Chainsaw Operating Policy.

b) Safety training for protecting the public and other crewmembers while felling, bucking, limbing, or removal operations are occurring.

3. The Program Manager would be responsible for developing programs to enhance staff expertise and coordinating training. This might be done by utilizing consultants, cooperative opportunities with other agencies or arranging specific training courses.

Section 1: HAZARD TREE MANAGEMENT DECISION TREE





*Backcountry – Minimum Requirement/Tool Analysis

Section 2: TREE RATING CRITERIA USED IN SURVEYS

Criteria used to identify a hazard tree include observable defects in tree condition that result in high risk for failure, and potential of the tree to strike a target when it fails.

Each tree would be carefully surveyed for the presence of defects. Trees with defects would be rated no, low, medium, high, or very high (0-4), as to their likelihood of failure during the current season (USDI 1991). Trees with no defects would automatically fall into the no hazard category.

The potential impact to the target would also be rated low, medium, or high (1-3) according to the value of the structure and/or human use levels and the probability of hitting a target.

Tree Evaluation Factors:
Examinations of the potential hazard trees identified in surveillance surveys must be done systematically. All observed defects are documented. Factors used to rate tree condition include:

A. External condition and appearance
B. Occurrence and extent of heart rot
C. Amount of sound wood remaining
D. Multiple Defects or Conditions

A. External Condition
Johnson (1981) lists the following defects in order of importance to be noted on trees. These are observable conditions that can be documented during the examination survey, and evaluated.

1. Dead trees
2. Leaning trees
3. Root injuries
4. Crown injuries
5. Insect Activity

Weakness in the tree can result from physical injury, disease, or insect activity. Two or more defects occurring together might sometimes render a tree hazardous when it might not be if it had only one defect. Examples include the combination of a sap rot and a heart rot, or one of a leaning tree with a large basal wound in line with the direction of lean. Other combinations are possible and should be looked for in the course of inspections.

Detailed information regarding types of diseases and tree species specific problems can be found in various publications (Hagle et al. 2003, 2003b; Larson 1984; Johnson 1981; Hamilton and Edwards 1976; and Wagener 1963). It is recommended that the observer use these reports to be familiar with species specific problems. It is not the intent of this plan to replace technical references used in field examinations. These field guides are important references to use in documenting tree condition. Since there is interest in the criteria used to predict tree failure, it might be helpful to list factors as indicators of high risk for failure.

Tree defects to watch for that are indicators of high failure potential are listed in Table 4.

B. Occurrence and Extent of Heart Rot
One of the most common defects to look for and assess in trees is heart rot or hollowness of the trunk resulting from it. Expect this defect particularly in trees bearing conks or showing old wounds, either open or closed. Occasionally, however, an old tree would be hollow with little outside evidence of heart rot. Keep in mind that a tree need not be large to be hollow.

The rate of recent diameter growth is a useful index of the probable failure of any tree with heart rot or hollowness. Trees that are making good growth would have thicker sapwood than those growing slowly and should be less likely to fail. The condition of callus growth around wounds is also of indicator value. If growth of the tree is good, callusing would be good and the bark over the callus would be thin and healthy in appearance. The crown would also be thrifty.

One test for heart rot or hollowness of the lower trunk consists in "sounding" the trunk by striking it sharply with the poll of an axe. If hollow or decayed and the surrounding wood is not too thick, the blow on the trunk would produce a hollow sound distinguishable from that produced when a solid trunk is struck in this manner.

For a more positive method of testing for hollowness, sample the lower trunk with an increment borer. If the borer breaks through into rot or a hollow resulting from the collapse of rot, the extracted core would give the thickness of the surrounding wall of solid wood at that point and also an opportunity to judge the rate of recent growth. [When heart rot is suspected, an increment core would be extracted to determine the extent of the rot and the thickness of sound wood so that the hazard level can be determined. See 'judging the hazard' section below. When using an increment borer, do not bore into the tree more than what is necessary to determine minimum thickness of sound wood (see Table 4).

C. Amount of Sound Wood Remaining

As mentioned above, the presence of any of the listed defects does not automatically constitute a hazard. Many trees are sound even though they might be hollow. The extent of tree weakening must be determined in order to determine the potential of failure.

In order to determine the strength of a tree with heart rot, an increment core is needed. A tree with heart rot might lose up to 70 percent of wood inside the bark without affecting its integrity (Wagener 1963). Table 3 gives the minimum thickness of sound wood needed to maintain various diameters of trees.

D. Multiple Defects or Conditions

Two or more defects occurring together might sometimes render a tree hazardous when it might not be if it had only one defect. Examples include the combination of a sap rot and a heart rot, or one of a leaning tree with a large basal wound in line with the direction of lean. Other combinations are possible and should be looked for in the course of inspections.

Table 3. Minimum requirement for defective trees.

Diameter of tree inside bark (inches)	Thickness of sound wood (inches)
16	2.5
20	3.0
24	3.5
28	4.0
32	4.5
36	5.5
40	6.0
44	6.5
48	7.0
52	8.0
56	8.5
60	9.0
64	9.5
68	10.0
Applied as average thickness of outer sound wood of the trunk with center rot or hollow representing 70 percent of the total wood diameter, equivalent to one-third loss in strength (Wagener 1963).	

Table 4. Tree rating criteria to be used in examination surveys.

LOCATION OF FAILURE	DEFECT	LOW FAILURE POTENTIAL	HIGH FAILURE POTENTIAL
WHOLE TREE FAILURE	**DEAD**		
	WINDFALL		
	LEANING TREE**	Old lean, upper section of the stem growing vertically.	Recent lean, soil around tree cracked or having indicated recent movement. Near water or high water mark.
	LEANING TREE (conifers)**	Trees that have grown in a leaning position.	If (a) the lean has been caused by an outside force, or (b) an open wound with advanced decay and poor calluses is in line with the direction of lean. Near water or high water mark.
	LEANING TREE (deciduous) **		If the lean is extreme and the leverage great for the strength of the wood. Near water or high water mark.
	FORKED STEMS (conifer except cedar)	Forked stems, one or both fork being of a small diameter.	Large, long, and heavy forked stems joined part way up the stem. The crotch of the fork is at right angles to the direction of heaviest winds.
	FORKS (cedar)	Forks and crooks.	
	FROST CRACKS	Frost cracks.	
ROOT AND BUTT FAILURE	**BUTT ROT (deciduous)**	Decay in butt confined to small, localized area. Decay extensive throughout the heartwood in the butt.	
	CANKERS (conifers except cedar and deciduous)	Butt cankers with the bark still intact.	Butt cankers affecting a major portion of the circumference of the stem and with much of the canker tissue dead.
	FROST CRACKS (conifer except cedar)	Frost cracks with little or no associated advanced decay.	Frost cracks with extensive associated advanced decay.

LOCATION OF FAILURE	DEFECT	LOW FAILURE POTENTIAL	HIGH FAILURE POTENTIAL
	FRUITING BODIES (conifer except cedar)		Fruiting bodies at the butt of the tree, or on the ground around the tree.
	FRUITING BODIES (cedar and deciduous)		Fruiting bodies on lower bole.
	HOLLOW BUTT (conifers except cedar)	Hollow butt if less than a quarter of the stem is affected.	Hollow butt if a majority of the stem is decayed.
	HOLLOW BUTT (cedar)	Hollow butt provided less than a half of the circumference of the stem is affected.	Hollow butt with more than half of the circumference affected and with significant advanced decay.
	HOLLOW BUTT (deciduous)	Hollow in butt confined to a small section of stem.	Hollow in butt affecting a major portion of the circumference of the stem.
	MYCELIUM (conifer except cedar)	*Phellinus weirii* mycelium on the roots but no stain or decay in the butt.	*Phellinus weirii* mycelium on the roots and red-brown stain and/or decay in the butt.
	MYCELIUM (deciduous)	Mycelium below the bark near the ground line confined to less than half the circumference of the stem.	Mycelium below the bark near the ground line affecting most of the circumference of the stem.
	PAVEMENT	Pavement, asphalt over roots; not hazardous in itself but favors the development of hazardous conditions.	
	RESIN (conifer except cedar)	Resin flow from the butt near the ground line, with less than half the circumference of the stem affected.	Resin flow from the butt near the ground line, with most of the circumference of the stem affected. Mycelium fans below the bark.
	ROOT INJURY	Few small roots severed or injured.	Most of the roots on one or more sides of the tree severed or badly damaged.
	SOIL	Cracks or heaving in soil around tree indicating recent movement.	Most of the roots on one or more sides of the tree severed or badly damaged.

LOCATION OF FAILURE	DEFECT	LOW FAILURE POTENTIAL	HIGH FAILURE POTENTIAL
	WOUNDS	Visible damage to roots, roots more exposed than before wound occurrence.	
STEM DECAY	**BURLS (deciduous)**	Burls or galls.	
	CONKS (conifers and deciduous)	Small and few in number.	Many, large and wide-spread in the stand.
STEM DAMAGE	**DWARF MISTLETOE (conifer except cedar)***	Dwarf mistletoe stem canker with the bark still intact.	Dwarf mistletoe stem canker with more than a half the circumference dead.
	CANKERS (lodgepole and ponderosa pine)	Cankers, horizontal, when low on trunks.	Cankers, horizontal, when deep and above 16 feet from the ground.
	BLISTER RUST (White, ponderosa, and lodgepole pines)	Orange or yellow discoloration of thin bark, sporulating.	Blisters have girdled the stem, causing branch flagging or death.
	GALLS	Branch gall, stem cankers.	Easily infected, galls girdled the tree.
	MOTHS	Pitch tube present, tree looks healthy.	A lot of pitching, small-diameter, near root collar.
	PITCH TUBES		Extensive pitching, bark beetles, woodborers, wooly adelgids present, tree dying.
	WHITE, WOOLLY		Dying or dead branches and crowns.
	ANIMAL DAMAGE	Partial girdling from chewing, scratching, rubbing, shredding the bark and cambium; browsing of buds .	Girdling from chewing, scratching, rubbing, shredding the bark and cambium; canker formed around stem.
	FRUITING BODIES	One or two small fruiting bodies in the upper stem.	Multiple fruiting bodies along the length of the stem.

LOCATION OF FAILURE	DEFECT	LOW FAILURE POTENTIAL	HIGH FAILURE POTENTIAL
	HEART ROT (deciduous)		Extensive heart rot, hollow stem.
	TWIN STEMS (cedar)	Small twin stems.	Large twin stems joined part way up the stem.
TERMINALS AND BRANCHES	**BRANCH CROTCH (deciduous)**	Sound crotch.	Split crotch.
	BROKEN TOPS	Broken tops with adjacent branches healthy.	Broken tops with adjacent branches unhealthy.
	CANKERS (conifer except cedar)	Top and branch cankers with the bark still intact.	Top cankers where most of the canker face is dead.
	DEAD BRANCHES (cedar and deciduous)	Small dead branches.	Large dead branches, especially if broken and ledged in other branches.
	DEAD TOPS (conifer except cedar)	Small tops, dead spike, on pines and Douglas-firs if old, without bark and deeply weathered.	Large tops and branches, dead on other species, or bark-covered on pine or Douglas-fir (includes dead volunteer tops).
	DECAY (deciduous)	Branches with little or no decay associated with crotch.	Extensive decay in stem and lower portion of large branches.
	DWARF MISTLETOES (conifer except cedar)	Small dwarf mistletoe branch and top swellings and witches' broom.	Large dwarf mistletoe, witches' brooms on branches.
	FORKED TOPS (conifer except cedar)	Small forked tops and crooks.	Large forked tops.
	FRUITING BODIES (conifer except cedar)	One or two small fruiting bodies in top of stem.	Numerous fruiting bodies in top of stem.
	MULTIPLE LEADERS	Small, live and thrifty volunteer tops.	Heavy U-shaped branches formed when side branches turn up to become leaders.

LOCATION OF FAILURE	DEFECT	LOW FAILURE POTENTIAL	HIGH FAILURE POTENTIAL
	SPIKE TOPS (cedar)	Spike top not weakened by woodpeckers or decay.	Spike top weakened by woodpeckers or decay.
FOLIAGE	**DISCOLORATION (conifer except cedar)**		Thin chlorotic foliage indicates a tree is dying because of root rot, blight, needle diseases, or insect (budworm, casebearers, sawfly, weevils, scale, etc.) damage.
	CURLING/BROWNING	Damage concentrated at "spray heights" (lower to mid – tree) (indicates toxin applied).	Damage concentrated at tops of tree and tips of branches (indicates root uptake or source is above treetop).

* Main stem or trunk swellings, from stem infections by dwarf mistletoe when the host trees were young, might be quite prevalent on true firs. As long as the swelling remains alive, it does not weaken the trunk, but eventually the cambium in the oldest part of the swelling dies. The bark over the dead part soon becomes broken, creating an open canker. Decay usually develops in the dead wood, although its progress in different cankers is variable. The eventual result is a weakening of the trunk at the host tree at the site of the canker. The status of the weakening cannot be judged closely from surface conditions, but when the width of the dead face approaches half the circumference of the swelling, the trunk might break at the canker site under the stress of heavy wind or snow conditions. Most such breaks occur during winter storms, but they can take place at other times.

Open dwarf mistletoe cankers are sometimes found on the lower trunks of ponderosa pines, but the wood around them becomes heavily resin-infiltrated, protecting them from decay. They do not appear to contribute in any way to hazard.

** It is difficult to predict failure potential of leaning trees based on the angle of lean. The cause of the lean must be determined. A tree which has grown in a leaning position structurally compensates for the lean. In stress places, wood that is stronger than that in the vertical portions is formed. Such leaning trees have a low failure potential. Trees that lean because of root loosening caused by an outside force, such as heavy wind, flood waters, or a falling tree or snag have higher failure potential. These trees have not developed the stronger wood at these stress points. An old open fire wound might occasionally render a leaning tree hazardous if the wound is in line with the axis of strain from the lean and if advanced rot is present in the wood behind the wound.

Section 3: DETERMINATION OF THE PROABABILITY THAT A TREE WOULD HIT A STATIONARY TARGET

Determination of the probability that a tree would hit a stationary target is based on the lean of the tree, width of the target, and the distance the tree is from the target. Using the angle within striking distance tables, the probability levels can be determined using the following steps:

1. Does the tree have a structurally defective lean?
   - No……..low probability
   - Yes……..use Table B, go to step 2

2. Find the maximum width of the structure across the top row.
3. Follow the maximum width column down to the distance the tree is from the object.
4. Determine where the angle falls in relation to the probability level lines:
   - Below the single line……..low probability
   - Between the single and double lines……...medium probability
   - Above the double line……high probability

Assumptions of the tables:

The tree is at the center of the width of the target and it would fall perpendicular to the target. For trees which this is not the case, the table would slightly overestimate the striking angles and resultant probability level.

The tree's height equals or exceeds the distance from the building.

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

TARGET WIDTH

DISTANCE FROM TARGET	1	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
1	53	157	169	172	174	175	176	177	177	177	178	178	178	178	178	178
5	11	90	127	143	152	157	161	164	166	167	169	170	170	171	172	172
10	6	53	90	113	127	136	143	148	152	155	157	159	161	163	164	165
15	4	37	67	90	106	118	127	134	139	143	147	149	152	154	156	157
20	3	28	53	74	90	103	113	121	127	132	136	140	143	146	148	150
25	2	23	44	62	77	90	100	109	116	122	127	131	135	138	141	143
30	2	19	37	53	67	80	90	99	106	113	118	123	127	130	134	136
35	2	16	32	46	59	71	81	90	98	104	110	115	119	123	127	130
40	1	14	28	41	53	64	74	82	90	97	103	108	113	117	121	124
45	1	13	25	37	48	58	67	76	83	90	96	101	106	111	115	118
50	1	11	23	33	44	53	62	70	77	84	90	95	100	105	109	113
55	1	10	21	31	40	49	57	65	72	79	85	90	95	100	104	107
60	1	10	19	28	37	45	53	61	67	74	80	85	90	95	99	103
65	1	9	17	26	34	42	50	57	63	69	75	80	85	90	94	98
70	1	8	16	24	32	39	46	53	59	65	71	76	81	86	90	94
75	1	8	15	23	30	37	44	50	56	62	67	73	77	82	86	90
80	1	7	14	21	28	35	41	47	53	59	64	69	74	78	82	86
85	1	7	13	20	26	33	39	45	50	56	61	66	70	75	79	83
90	1	6	13	19	25	31	37	43	48	53	58	63	67	72	76	80
95	1	6	12	18	24	29	35	40	46	51	56	60	65	69	73	77
100	1	6	11	17	23	28	33	39	44	48	53	58	62	66	70	74
105	1	5	11	16	22	27	32	37	42	46	51	55	59	64	67	71
110	1	5	10	16	21	26	31	35	40	44	49	53	57	61	65	69
115	0	5	10	15	20	25	29	34	38	43	47	51	55	59	63	66
120	0	5	10	14	19	24	28	33	37	41	45	49	53	57	61	64
125	0	5	9	14	18	23	27	31	35	40	44	47	51	55	58	62
130	0	4	9	13	17	22	26	30	34	38	42	46	50	53	57	60
135	0	4	8	13	17	21	25	29	33	37	41	44	48	51	55	58
140	0	4	8	12	16	20	24	28	32	36	39	43	46	50	53	56
145	0	4	8	12	16	20	23	27	31	34	38	42	45	48	52	55
150	0	4	8	11	15	19	23	26	30	33	37	40	44	47	50	53
155	0	4	7	11	15	18	22	25	29	32	36	39	42	46	49	52
160	0	4	7	11	14	18	21	25	28	31	35	38	41	44	47	50
165	0	3	7	10	14	17	21	24	27	31	34	37	40	43	46	49
170	0	3	7	10	13	17	20	23	26	30	33	36	39	42	45	48
175	0	3	7	10	13	16	19	23	26	29	32	35	38	41	44	46
180	0	3	6	10	13	16	19	22	25	28	31	34	37	40	43	45
185	0	3	6	9	12	15	18	21	24	27	30	33	36	39	41	44
190	0	3	6	9	12	15	18	21	24	27	29	32	35	38	40	43
195	0	3	6	9	12	15	17	20	23	26	29	32	34	37	39	42
200	0	3	6	9	11	14	17	20	23	25	28	31	33	36	39	41

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

TARGET WIDTH

DISTANCE FROM TARGET	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
1	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
5	173	173	174	174	174	175	175	175	175	175	176	176	176	176	176
10	166	167	167	168	169	169	170	170	170	171	171	172	172	172	172
15	159	160	161	162	163	164	164	165	166	166	167	167	168	168	169
20	152	154	155	156	157	158	159	160	161	162	163	163	164	164	165
25	145	147	149	151	152	153	154	155	156	157	158	159	160	160	161
30	139	141	143	145	147	148	149	151	152	153	154	155	156	157	157
35	133	135	137	140	141	143	145	146	147	149	150	151	152	153	154
40	127	130	132	134	136	138	140	142	143	145	146	147	148	149	150
45	121	124	127	129	132	134	136	137	139	140	142	143	144	146	147
50	116	119	122	124	127	129	131	133	135	136	138	139	141	142	143
55	111	114	117	120	122	125	127	129	131	133	134	136	137	138	140
60	106	110	113	115	118	121	123	125	127	129	130	132	134	135	136
65	102	105	108	111	114	116	119	121	123	125	127	129	130	132	133
70	98	101	104	107	110	113	115	117	119	122	123	125	127	128	130
75	94	97	100	103	106	109	111	114	116	118	120	122	124	125	127
80	90	93	97	100	103	105	108	110	113	115	117	119	121	122	124
85	87	90	93	96	99	102	105	107	109	112	114	116	117	119	121
90	83	87	90	93	96	99	101	104	106	108	111	113	115	116	118
95	80	84	87	90	93	96	98	101	103	106	108	110	112	114	115
100	77	81	84	87	90	93	95	98	100	103	105	107	109	111	113
105	75	78	81	84	87	90	93	95	98	100	102	104	106	108	110
110	72	75	79	82	85	87	90	93	95	97	100	102	104	106	107
115	70	73	76	79	82	85	87	90	92	95	97	99	101	103	105
120	67	71	74	77	80	82	85	88	90	92	95	97	99	101	103
125	65	68	72	74	77	80	83	85	88	90	92	94	96	98	100
130	63	66	69	72	75	78	80	83	85	88	90	92	94	96	98
135	61	64	67	70	73	76	78	81	83	86	88	90	92	94	96
140	59	63	65	68	71	74	76	79	81	84	86	88	90	92	94
145	58	61	64	66	69	72	74	77	79	82	84	86	88	90	92
150	56	59	62	65	67	70	73	75	77	80	82	84	86	88	90
155	55	57	60	63	66	68	71	73	75	78	80	82	84	86	88
160	53	56	59	61	64	67	69	71	74	76	78	80	82	84	86
165	52	55	57	60	62	65	67	70	72	74	76	79	81	83	85
170	50	53	56	58	61	63	66	68	70	73	75	77	79	81	83
175	49	52	54	57	59	62	64	67	69	71	73	75	77	79	81
180	48	51	53	56	58	61	63	65	67	70	72	74	76	78	80
185	47	49	52	54	57	59	61	64	66	68	70	72	74	76	78
190	46	48	51	53	56	58	60	62	65	67	69	71	73	75	77
195	45	47	50	52	54	57	59	61	63	65	67	69	71	73	75
200	44	46	48	51	53	55	58	60	62	64	66	68	70	72	74

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

TARGET WIDTH

DISTANCE FROM TARGET	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450
1	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
5	176	176	177	177	177	177	177	177	177	177	177	177	177	177	177
10	173	173	173	173	173	174	174	174	174	174	174	175	175	175	175
15	169	169	170	170	170	170	171	171	171	171	172	172	172	172	172
20	165	166	166	167	167	167	168	168	168	169	169	169	169	170	170
25	162	162	163	163	164	164	165	165	165	166	166	166	167	167	167
30	158	159	159	160	161	161	162	162	163	163	163	164	164	164	165
35	155	155	156	157	157	158	159	159	160	160	161	161	162	162	162
40	151	152	153	154	154	155	156	156	157	157	158	158	159	159	160
45	148	149	149	150	151	152	153	153	154	155	155	156	156	157	157
50	144	145	146	147	148	149	150	151	151	152	153	153	154	154	155
55	141	142	143	144	145	146	147	148	148	149	150	151	151	152	153
60	138	139	140	141	142	143	144	145	146	147	147	148	149	149	150
65	134	136	137	138	139	140	141	142	143	144	145	146	146	147	148
70	131	133	134	135	136	137	139	140	141	141	142	143	144	145	145
75	128	130	131	132	134	135	136	137	138	139	140	141	142	142	143
80	125	127	128	130	131	132	133	134	135	136	137	138	139	140	141
85	123	124	125	127	128	129	131	132	133	134	135	136	137	138	139
90	120	121	123	124	126	127	128	129	130	132	133	134	135	136	136
95	117	119	120	122	123	124	126	127	128	129	130	131	132	133	134
100	114	116	118	119	121	122	123	124	126	127	128	129	130	131	132
105	112	113	115	117	118	119	121	122	123	125	126	127	128	129	130
110	109	111	113	114	116	117	119	120	121	122	124	125	126	127	128
115	107	109	110	112	113	115	116	118	119	120	121	123	124	125	126
120	105	106	108	110	111	113	114	115	117	118	119	121	122	123	124
125	102	104	106	107	109	110	112	113	115	116	117	118	120	121	122
130	100	102	104	105	107	108	110	111	113	114	115	116	118	119	120
135	98	100	101	103	105	106	108	109	111	112	113	115	116	117	118
140	96	98	99	101	103	104	106	107	109	110	111	113	114	115	116
145	94	96	97	99	101	102	104	105	107	108	109	111	112	113	114
150	92	94	95	97	99	100	102	103	105	106	108	109	110	111	113
155	90	92	94	95	97	99	100	102	103	104	106	107	108	110	111
160	88	90	92	93	95	97	98	100	101	103	104	105	107	108	109
165	86	88	90	92	93	95	97	98	100	101	102	104	105	106	107
170	85	87	88	90	92	93	95	96	98	99	101	102	103	105	106
175	83	85	87	88	90	92	93	95	96	98	99	100	102	103	104
180	81	83	85	87	88	90	92	93	95	96	97	99	100	101	103
185	80	82	83	85	87	88	90	92	93	94	96	97	99	100	101
190	78	80	82	84	85	87	88	90	91	93	94	96	97	98	100
195	77	79	80	82	84	85	87	89	90	91	93	94	96	97	98
200	76	77	79	81	82	84	86	87	89	90	91	93	94	95	97

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

DISTANCE FROM TARGET	TARGET WIDTH														
	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
1	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
5	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178
10	175	175	175	175	175	176	176	176	176	176	176	176	176	176	176
15	173	173	173	173	173	173	173	174	174	174	174	174	174	174	174
20	170	170	170	171	171	171	171	171	172	172	172	172	172	172	172
25	168	168	168	168	169	169	169	169	169	170	170	170	170	170	170
30	165	165	166	166	166	167	167	167	167	168	168	168	168	168	169
35	163	163	163	164	164	164	165	165	165	165	166	166	166	166	167
40	160	161	161	161	162	162	163	163	163	163	164	164	164	165	165
45	158	158	159	159	160	160	160	161	161	161	162	162	162	163	163
50	155	156	156	157	157	158	158	159	159	159	160	160	160	161	161
55	153	154	154	155	155	156	156	157	157	157	158	158	159	159	159
60	151	151	152	152	153	154	154	154	155	155	156	156	157	157	157
65	148	149	150	150	151	151	152	152	153	153	154	154	155	155	156
70	146	147	147	148	149	149	150	150	151	151	152	152	153	153	154
75	144	145	145	146	147	147	148	148	149	149	150	151	151	151	152
80	142	142	143	144	145	145	146	146	147	148	148	149	149	150	150
85	139	140	141	142	142	143	144	144	145	146	146	147	147	148	148
90	137	138	139	140	140	141	142	142	143	144	144	145	146	146	147
95	135	136	137	138	138	139	140	141	141	142	143	143	144	144	145
100	133	134	135	136	136	137	138	139	139	140	141	141	142	143	143
105	131	132	133	134	134	135	136	137	137	138	139	140	140	141	141
110	129	130	131	132	133	133	134	135	136	136	137	138	138	139	140
115	127	128	129	130	131	131	132	133	134	135	135	136	137	137	138
120	125	126	127	128	129	130	130	131	132	133	134	134	135	136	136
125	123	124	125	126	127	128	129	129	130	131	132	133	133	134	135
130	121	122	123	124	125	126	127	128	129	129	130	131	132	132	133
135	119	120	121	122	123	124	125	126	127	128	129	129	130	131	132
140	117	118	119	121	122	122	123	124	125	126	127	128	128	129	130
145	116	117	118	119	120	121	122	123	124	124	125	126	127	128	128
150	114	115	116	117	118	119	120	121	122	123	124	124	125	126	127
155	112	113	114	115	116	117	118	119	120	121	122	123	124	125	125
160	110	112	113	114	115	116	117	118	119	120	121	121	122	123	124
165	109	110	111	112	113	114	115	116	117	118	119	120	121	122	122
170	107	108	109	110	112	113	114	115	116	117	117	118	119	120	121
175	105	107	108	109	110	111	112	113	114	115	116	117	118	119	119
180	104	105	106	107	108	110	111	112	113	114	115	115	116	117	118
185	102	104	105	106	107	108	109	110	111	112	113	114	115	116	117
190	101	102	103	104	106	107	108	109	110	111	112	113	114	114	115
195	99	101	102	103	104	105	106	107	108	109	110	111	112	113	114
200	98	99	100	102	103	104	105	106	107	108	109	110	111	112	113

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

TARGET WIDTH

DISTANCE FROM TARGET	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750
1	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
5	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178
10	176	176	176	176	176	177	177	177	177	177	177	177	177	177	177
15	174	174	175	175	175	175	175	175	175	175	175	175	175	175	175
20	172	173	173	173	173	173	173	173	173	173	174	174	174	174	174
25	171	171	171	171	171	171	171	172	172	172	172	172	172	172	172
30	169	169	169	169	169	170	170	170	170	170	170	170	171	171	171
35	167	167	167	168	168	168	168	168	168	169	169	169	169	169	169
40	165	165	166	166	166	166	166	167	167	167	167	167	167	168	168
45	163	163	164	164	164	164	165	165	165	165	166	166	166	166	166
50	161	162	162	162	163	163	163	163	164	164	164	164	164	165	165
55	160	160	160	160	161	161	161	162	162	162	162	163	163	163	163
60	158	158	158	159	159	159	160	160	160	161	161	161	161	162	162
65	156	156	157	157	157	158	158	158	159	159	159	160	160	160	160
70	154	155	155	155	156	156	156	157	157	157	158	158	158	159	159
75	152	153	153	154	154	154	155	155	155	156	156	156	157	157	157
80	151	151	151	152	152	153	153	154	154	154	155	155	155	156	156
85	149	149	150	150	151	151	152	152	152	153	153	153	154	154	154
90	147	148	148	149	149	149	150	150	151	151	152	152	152	153	153
95	145	146	146	147	147	148	148	149	149	150	150	150	151	151	152
100	144	144	145	145	146	146	147	147	148	148	149	149	149	150	150
105	142	143	143	144	144	145	145	146	146	147	147	147	148	148	149
110	140	141	142	142	143	143	144	144	145	145	146	146	146	147	147
115	139	139	140	140	141	142	142	143	143	144	144	145	145	145	146
120	137	138	138	139	139	140	141	141	142	142	143	143	144	144	145
125	135	136	137	137	138	139	139	140	140	141	141	142	142	143	143
130	134	134	135	136	136	137	138	138	139	139	140	140	141	141	142
135	132	133	134	134	135	136	136	137	137	138	138	139	139	140	140
140	131	131	132	133	133	134	135	135	136	136	137	137	138	139	139
145	129	130	131	131	132	133	133	134	134	135	136	136	137	137	138
150	128	128	129	130	130	131	132	132	133	134	134	135	135	136	136
155	126	127	128	128	129	130	130	131	132	132	133	133	134	135	135
160	125	125	126	127	128	128	129	130	130	131	131	132	133	133	134
165	123	124	125	125	126	127	128	128	129	130	130	131	131	132	133
170	122	123	123	124	125	125	126	127	128	128	129	129	130	131	131
175	120	121	122	123	123	124	125	126	126	127	128	128	129	129	130
180	119	120	121	121	122	123	124	124	125	126	126	127	127	128	129
185	118	118	119	120	121	121	122	123	124	124	125	126	126	127	127
190	116	117	118	119	119	120	121	122	122	123	124	124	125	126	126
195	115	116	116	117	118	119	120	120	121	122	122	123	124	124	125
200	113	114	115	116	117	118	118	119	120	121	121	122	123	123	124

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

DISTANCE FROM TARGET	TARGET WIDTH														
	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900
1	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
5	178	179	179	179	179	179	179	179	179	179	179	179	179	179	179
10	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
15	175	176	176	176	176	176	176	176	176	176	176	176	176	176	176
20	174	174	174	174	174	174	174	174	175	175	175	175	175	175	175
25	172	173	173	173	173	173	173	173	173	173	173	173	173	174	174
30	171	171	171	171	171	172	172	172	172	172	172	172	172	172	172
35	169	170	170	170	170	170	170	170	170	171	171	171	171	171	171
40	168	168	168	168	169	169	169	169	169	169	169	169	170	170	170
45	166	167	167	167	167	167	167	168	168	168	168	168	168	168	169
50	165	165	165	166	166	166	166	166	166	167	167	167	167	167	167
55	164	164	164	164	164	165	165	165	165	165	165	166	166	166	166
60	162	162	163	163	163	163	163	164	164	164	164	164	164	165	165
65	161	161	161	161	162	162	162	162	162	163	163	163	163	163	164
70	159	159	160	160	160	160	161	161	161	161	162	162	162	162	162
75	158	158	158	158	159	159	159	160	160	160	160	160	161	161	161
80	156	157	157	157	157	158	158	158	158	159	159	159	159	160	160
85	155	155	155	156	156	156	157	157	157	157	158	158	158	158	159
90	153	154	154	154	155	155	155	156	156	156	156	157	157	157	157
95	152	152	153	153	153	154	154	154	155	155	155	155	156	156	156
100	151	151	151	152	152	152	153	153	153	154	154	154	154	155	155
105	149	149	150	150	151	151	151	152	152	152	153	153	153	153	154
110	148	148	148	149	149	150	150	150	151	151	151	152	152	152	153
115	146	147	147	148	148	148	149	149	149	150	150	150	151	151	151
120	145	145	146	146	147	147	147	148	148	148	149	149	149	150	150
125	144	144	144	145	145	146	146	146	147	147	148	148	148	149	149
130	142	143	143	144	144	144	145	145	146	146	146	147	147	147	148
135	141	141	142	142	143	143	144	144	144	145	145	146	146	146	147
140	140	140	141	141	141	142	142	143	143	144	144	144	145	145	145
145	138	139	139	140	140	141	141	141	142	142	143	143	144	144	144
150	137	137	138	138	139	139	140	140	141	141	142	142	142	143	143
155	136	136	137	137	138	138	139	139	139	140	140	141	141	142	142
160	134	135	135	136	136	137	137	138	138	139	139	140	140	140	141
165	133	134	134	135	135	136	136	137	137	138	138	138	139	139	140
170	132	132	133	133	134	134	135	135	136	136	137	137	138	138	139
175	131	131	132	132	133	133	134	134	135	135	136	136	137	137	137
180	129	130	130	131	132	132	133	133	134	134	135	135	136	136	136
185	128	129	129	130	130	131	131	132	132	133	133	134	134	135	135
190	127	127	128	129	129	130	130	131	131	132	132	133	133	134	134
195	126	126	127	127	128	129	129	130	130	131	131	132	132	133	133
200	124	125	126	126	127	127	128	129	129	130	130	131	131	132	132

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

TARGET WIDTH

DISTANCE FROM TARGET	910	920	930	940	950	960	970	980	990	1000	1010	1020	1030	1040	1050
1	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
5	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
10	177	178	178	178	178	178	178	178	178	178	178	178	178	178	178
15	176	176	176	176	176	176	176	176	177	177	177	177	177	177	177
20	175	175	175	175	175	175	175	175	175	175	175	176	176	176	176
25	174	174	174	174	174	174	174	174	174	174	174	174	174	174	175
30	172	173	173	173	173	173	173	173	173	173	173	173	173	173	173
35	171	171	171	171	172	172	172	172	172	172	172	172	172	172	172
40	170	170	170	170	170	170	171	171	171	171	171	171	171	171	171
45	169	169	169	169	169	169	169	170	170	170	170	170	170	170	170
50	167	168	168	168	168	168	168	168	168	169	169	169	169	169	169
55	166	166	167	167	167	167	167	167	167	167	168	168	168	168	168
60	165	165	165	165	166	166	166	166	166	166	166	167	167	167	167
65	164	164	164	164	164	165	165	165	165	165	165	165	166	166	166
70	163	163	163	163	163	163	164	164	164	164	164	164	165	165	165
75	161	161	162	162	162	162	162	163	163	163	163	163	163	164	164
80	160	160	160	161	161	161	161	161	162	162	162	162	162	163	163
85	159	159	159	159	160	160	160	160	161	161	161	161	161	161	162
90	158	158	158	158	159	159	159	159	159	160	160	160	160	160	161
95	156	157	157	157	157	158	158	158	158	158	159	159	159	159	159
100	155	155	156	156	156	156	157	157	157	157	158	158	158	158	158
105	154	154	155	155	155	155	156	156	156	156	157	157	157	157	157
110	153	153	153	154	154	154	154	155	155	155	155	156	156	156	156
115	152	152	152	153	153	153	153	154	154	154	154	155	155	155	155
120	150	151	151	151	152	152	152	152	153	153	153	154	154	154	154
125	149	150	150	150	151	151	151	151	152	152	152	152	153	153	153
130	148	148	149	149	149	150	150	150	151	151	151	151	152	152	152
135	147	147	148	148	148	149	149	149	149	150	150	150	151	151	151
140	146	146	146	147	147	147	148	148	148	149	149	149	150	150	150
145	145	145	145	146	146	146	147	147	147	148	148	148	149	149	149
150	144	144	144	145	145	145	146	146	146	147	147	147	148	148	148
155	142	143	143	143	144	144	145	145	145	146	146	146	146	147	147
160	141	142	142	142	143	143	143	144	144	145	145	145	145	146	146
165	140	141	141	141	142	142	142	143	143	143	144	144	144	145	145
170	139	139	140	140	141	141	141	142	142	142	143	143	143	144	144
175	138	138	139	139	140	140	140	141	141	141	142	142	142	143	143
180	137	137	138	138	138	139	139	140	140	140	141	141	141	142	142
185	136	136	137	137	137	138	138	139	139	139	140	140	140	141	141
190	135	135	136	136	136	137	137	138	138	138	139	139	139	140	140
195	134	134	134	135	135	136	136	137	137	137	138	138	139	139	139
200	133	133	133	134	134	135	135	136	136	136	137	137	138	138	138

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

TARGET WIDTH

DISTANCE FROM TARGET	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	1180	1190	1200
1	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
5	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
10	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178
15	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
20	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176
25	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
30	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174
35	172	173	173	173	173	173	173	173	173	173	173	173	173	173	173
40	171	171	172	172	172	172	172	172	172	172	172	172	172	172	172
45	170	170	170	171	171	171	171	171	171	171	171	171	171	171	171
50	169	169	169	170	170	170	170	170	170	170	170	170	170	170	170
55	168	168	168	168	169	169	169	169	169	169	169	169	169	169	170
60	167	167	167	167	168	168	168	168	168	168	168	168	168	168	169
65	166	166	166	166	167	167	167	167	167	167	167	167	167	168	168
70	165	165	165	165	165	166	166	166	166	166	166	166	166	167	167
75	164	164	164	164	164	165	165	165	165	165	165	165	166	166	166
80	163	163	163	163	163	164	164	164	164	164	164	164	165	165	165
85	162	162	162	162	162	163	163	163	163	163	163	163	164	164	164
90	161	161	161	161	161	162	162	162	162	162	162	163	163	163	163
95	160	160	160	160	160	161	161	161	161	161	161	162	162	162	162
100	159	159	159	159	159	160	160	160	160	160	160	161	161	161	161
105	158	158	158	158	158	159	159	159	159	159	159	160	160	160	160
110	157	157	157	157	157	158	158	158	158	158	159	159	159	159	159
115	156	156	156	156	156	157	157	157	157	157	158	158	158	158	158
120	154	155	155	155	155	156	156	156	156	156	157	157	157	157	157
125	153	154	154	154	154	155	155	155	155	155	156	156	156	156	156
130	152	153	153	153	153	154	154	154	154	155	155	155	155	155	156
135	151	152	152	152	152	153	153	153	153	154	154	154	154	154	155
140	150	151	151	151	151	152	152	152	152	153	153	153	153	154	154
145	149	150	150	150	150	151	151	151	151	152	152	152	152	153	153
150	148	149	149	149	149	150	150	150	151	151	151	151	151	152	152
155	147	148	148	148	149	149	149	149	150	150	150	150	151	151	151
160	146	147	147	147	148	148	148	148	149	149	149	149	150	150	150
165	145	146	146	146	147	147	147	147	148	148	148	148	149	149	149
170	144	145	145	145	146	146	146	147	147	147	147	148	148	148	148
175	143	144	144	144	145	145	145	146	146	146	146	147	147	147	147
180	142	143	143	143	144	144	144	145	145	145	146	146	146	146	147
185	142	142	142	143	143	143	143	144	144	144	145	145	145	145	146
190	141	141	141	142	142	142	143	143	143	143	144	144	144	145	145
195	140	140	140	141	141	141	142	142	142	143	143	143	143	144	144
200	139	139	139	140	140	140	141	141	141	142	142	142	143	143	143

TABLE A FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITHOUT A LEAN

TARGET WIDTH

DISTANCE FROM TARGET	1210	1220	1230	1240	1250	1260	1270	1280	1290	1300	1310	1320	1330	1340	1350
1	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
5	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
10	178	178	178	178	178	178	178	178	178	178	178	178	178	178	178
15	177	177	177	177	177	177	177	177	177	177	177	177	177	177	177
20	176	176	176	176	176	176	176	176	176	176	177	177	177	177	177
25	175	175	175	175	175	175	175	176	176	176	176	176	176	176	176
30	174	174	174	174	175	175	175	175	175	175	175	175	175	175	175
35	173	173	173	174	174	174	174	174	174	174	174	174	174	174	174
40	172	172	173	173	173	173	173	173	173	173	173	173	173	173	173
45	171	172	172	172	172	172	172	172	172	172	172	172	172	172	172
50	171	171	171	171	171	171	171	171	171	171	171	171	171	171	172
55	170	170	170	170	170	170	170	170	170	170	170	170	171	171	171
60	169	169	169	169	169	169	169	169	169	169	170	170	170	170	170
65	168	168	168	168	168	168	168	168	168	169	169	169	169	169	169
70	167	167	167	167	167	167	167	168	168	168	168	168	168	168	168
75	166	166	166	166	166	166	167	167	167	167	167	167	167	167	167
80	165	165	165	165	165	166	166	166	166	166	166	166	166	166	166
85	164	164	164	164	165	165	165	165	165	165	165	165	165	166	166
90	163	163	163	163	164	164	164	164	164	164	164	164	165	165	165
95	162	162	162	163	163	163	163	163	163	163	163	164	164	164	164
100	161	161	162	162	162	162	162	162	162	163	163	163	163	163	163
105	160	160	161	161	161	161	161	161	162	162	162	162	162	162	162
110	159	160	160	160	160	160	160	160	161	161	161	161	161	161	161
115	158	159	159	159	159	159	159	160	160	160	160	160	160	161	161
120	158	158	158	158	158	158	159	159	159	159	159	159	160	160	160
125	157	157	157	157	157	158	158	158	158	158	158	159	159	159	159
130	156	156	156	156	157	157	157	157	157	157	158	158	158	158	158
135	155	155	155	155	156	156	156	156	156	157	157	157	157	157	157
140	154	154	154	155	155	155	155	155	156	156	156	156	156	156	157
145	153	153	153	154	154	154	154	154	155	155	155	155	155	156	156
150	152	152	153	153	153	153	153	154	154	154	154	154	155	155	155
155	151	151	152	152	152	152	153	153	153	153	153	154	154	154	154
160	150	151	151	151	151	151	152	152	152	152	153	153	153	153	153
165	149	150	150	150	150	151	151	151	151	152	152	152	152	152	153
170	149	149	149	149	150	150	150	150	150	151	151	151	151	152	152
175	148	148	148	148	149	149	149	149	150	150	150	150	151	151	151
180	147	147	147	148	148	148	148	149	149	149	149	149	150	150	150
185	146	146	147	147	147	147	148	148	148	148	148	149	149	149	149
190	145	145	146	146	146	146	147	147	147	147	148	148	148	148	149
195	144	145	145	145	145	146	146	146	146	147	147	147	147	148	148
200	143	144	144	144	145	145	145	145	146	146	146	146	147	147	147

TABLE B FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITH A STRUCTURALLY DEFECTIVE LEAN

TARGET WIDTH

DISTANCE FROM TARGET	1	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
1	53	157	169	172	174	175	176	177	177	177	178	178	178	178	178	178
5	11	90	127	143	152	157	161	164	166	167	169	170	170	171	172	172
10	6	53	90	113	127	136	143	148	152	155	157	159	161	163	164	165
15	4	37	67	90	106	118	127	134	139	143	147	149	152	154	156	157
20	3	28	53	74	90	103	113	121	127	132	136	140	143	146	148	150
25	2	23	44	62	77	90	100	109	116	122	127	131	135	138	141	143
30	2	19	37	53	67	80	90	99	106	113	118	123	127	130	134	136
35	2	16	32	46	59	71	81	90	98	104	110	115	119	123	127	130
40	1	14	28	41	53	64	74	82	90	97	103	108	113	117	121	124
45	1	13	25	37	48	58	67	76	83	90	96	101	106	111	115	118
50	1	11	23	33	44	53	62	70	77	84	90	95	100	105	109	113
55	1	10	21	31	40	49	57	65	72	79	85	90	95	100	104	107
60	1	10	19	28	37	45	53	61	67	74	80	85	90	95	99	103
65	1	9	17	26	34	42	50	57	63	69	75	80	85	90	94	98
70	1	8	16	24	32	39	46	53	59	65	71	76	81	86	90	94
75	1	8	15	23	30	37	44	50	56	62	67	73	77	82	86	90
80	1	7	14	21	28	35	41	47	53	59	64	69	74	78	82	86
85	1	7	13	20	26	33	39	45	50	56	61	66	70	75	79	83
90	1	6	13	19	25	31	37	43	48	53	58	63	67	72	76	80
95	1	6	12	18	24	29	35	40	46	51	56	60	65	69	73	77
100	1	6	11	17	23	28	33	39	44	48	53	58	62	66	70	74
105	1	5	11	16	22	27	32	37	42	46	51	55	59	64	67	71
110	1	5	10	16	21	26	31	35	40	44	49	53	57	61	65	69
115	0	5	10	15	20	25	29	34	38	43	47	51	55	59	63	66
120	0	5	10	14	19	24	28	33	37	41	45	49	53	57	61	64
125	0	5	9	14	18	23	27	31	35	40	44	47	51	55	58	62
130	0	4	9	13	17	22	26	30	34	38	42	46	50	53	57	60
135	0	4	8	13	17	21	25	29	33	37	41	44	48	51	55	58
140	0	4	8	12	16	20	24	28	32	36	39	43	46	50	53	56
145	0	4	8	12	16	20	23	27	31	34	38	42	45	48	52	55
150	0	4	8	11	15	19	23	26	30	33	37	40	44	47	50	53
155	0	4	7	11	15	18	22	25	29	32	36	39	42	46	49	52
160	0	4	7	11	14	18	21	25	28	31	35	38	41	44	47	50
165	0	3	7	10	14	17	21	24	27	31	34	37	40	43	46	49
170	0	3	7	10	13	17	20	23	26	30	33	36	39	42	45	48
175	0	3	7	10	13	16	19	23	26	29	32	35	38	41	44	46
180	0	3	6	10	13	16	19	22	25	28	31	34	37	40	43	45
185	0	3	6	9	12	15	18	21	24	27	30	33	36	39	41	44
190	0	3	6	9	12	15	18	21	24	27	29	32	35	38	40	43
195	0	3	6	9	12	15	17	20	23	26	29	32	34	37	39	42
200	0	3	6	9	11	14	17	20	23	25	28	31	33	36	39	41

TABLE B FOR DETERMINING ANGLE WITHIN STRIKING DISTANCE

FOR TREES WITH A STRUCTURALLY DEFECTIVE LEAN

DISTANCE FROM TARGET	TARGET WIDTH														
	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
1	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179
5	173	173	174	174	174	175	175	175	175	175	176	176	176	176	176
10	166	167	167	168	169	169	170	170	170	171	171	172	172	172	172
15	159	160	161	162	163	164	164	165	166	166	167	167	168	168	169
20	152	154	155	156	157	158	159	160	161	162	163	163	164	164	165
25	145	147	149	151	152	153	154	155	156	157	158	159	160	160	161
30	139	141	143	145	147	148	149	151	152	153	154	155	156	157	157
35	133	135	137	140	141	143	145	146	147	149	150	151	152	153	154
40	127	130	132	134	136	138	140	142	143	145	146	147	148	149	150
45	121	124	127	129	132	134	136	137	139	140	142	143	144	146	147
50	116	119	122	124	127	129	131	133	135	136	138	139	141	142	143
55	111	114	117	120	122	125	127	129	131	133	134	136	137	138	140
60	106	110	113	115	118	121	123	125	127	129	130	132	134	135	136
65	102	105	108	111	114	116	119	121	123	125	127	129	130	132	133
70	98	101	104	107	110	113	115	117	119	122	123	125	127	128	130
75	94	97	100	103	106	109	111	114	116	118	120	122	124	125	127
80	90	93	97	100	103	105	108	110	113	115	117	119	121	122	124
85	87	90	93	96	99	102	105	107	109	112	114	116	117	119	121
90	83	87	90	93	96	99	101	104	106	108	111	113	115	116	118
95	80	84	87	90	93	96	98	101	103	106	108	110	112	114	115
100	77	81	84	87	90	93	95	98	100	103	105	107	109	111	113
105	75	78	81	84	87	90	93	95	98	100	102	104	106	108	110
110	72	75	79	82	85	87	90	93	95	97	100	102	104	106	107
115	70	73	76	79	82	85	87	90	92	95	97	99	101	103	105
120	67	71	74	77	80	82	85	88	90	92	95	97	99	101	103
125	65	68	72	74	77	80	83	85	88	90	92	94	96	98	100
130	63	66	69	72	75	78	80	83	85	88	90	92	94	96	98
135	61	64	67	70	73	76	78	81	83	86	88	90	92	94	96
140	59	63	65	68	71	74	76	79	81	84	86	88	90	92	94
145	58	61	64	66	69	72	74	77	79	82	84	86	88	90	92
150	56	59	62	65	67	70	73	75	77	80	82	84	86	88	90
155	55	57	60	63	66	68	71	73	75	78	80	82	84	86	88
160	53	56	59	61	64	67	69	71	74	76	78	80	82	84	86
165	52	55	57	60	62	65	67	70	72	74	76	79	81	83	85
170	50	53	56	58	61	63	66	68	70	73	75	77	79	81	83
175	49	52	54	57	59	62	64	67	69	71	73	75	77	79	81
180	48	51	53	56	58	61	63	65	67	70	72	74	76	78	80
185	47	49	52	54	57	59	61	64	66	68	70	72	74	76	78
190	46	48	51	53	56	58	60	62	65	67	69	71	73	75	77
195	45	47	50	52	54	57	59	61	63	65	67	69	71	73	75
200	44	46	48	51	53	55	58	60	62	64	66	68	70	72	74

Section 4: SURVEY FORMS

Hazard Tree Record Forms

HAZARD TREE SURVEILLANCE RECORD Sheet __ of __

Subdistrict:_____ Site:_____ Inspector:_____ Date:_____

Tree #	Species	DBH	HT	Location of Tree	Description of Defect	Description of Target	Action Recommended

Sheet __ of __

HAZARD TREE EXAMINATION RECORD

Subdistrict:_____ Site:_____ Inspector:_____ Date:_____

Tree #	Species	DBH	HT	Perch Tree? Distance to Water	Description of Defect	Tree Failure Rating	Target Impact Rating	Hazard Rating	Action Recommended	Action Completed	
										Initials	Date

REPORT OF TREE FAILURE (Mechanical break, collapse, or uprooting)

REPORTING AGENCY:_____UNIT:_____

(A) Tree and stand
Species:_____
Approximate dbh of tree:_____inches
Approximate age of tree:_____years
Forest type:_____
Stand age class:____Overmature
____Mature
____Young-growth
____All-age
Elevation of site:_____

(B) Class of mechanical failure
___Upper bole (top half)
___Lower bole
___Butt (lower 6 feet)
___Limb
___Root, including uprooting

(C) Tree defect or fault leading to failure
___Rot (trunk, limb, or root)
___Sweep
___Tree dead – snag
___Fire wound
___Leaning
___Lightning wound
___Mechanical wound
___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
___Snow
___Erosion
___Soil-saturation
___Stream bank erosion
___Shallow rooting
___Tree striking tree
___Other:_____
___Unknown or none

(E) Time and location of incident
Approximate
Hour:_____
Month, year:_____
County:_____
State:_____
Site open for public use: Yes_____ No_____

(F) Land ownership
___Federal
___State
___Other public:_____
___Private
___Public utility

(G) Site category
___Established camp or picnic ground
___Other established public use site
___Volunteer site
___Marked trail
___Special use site
___Roadside
___Residence site
___Other:_____
___Urban

(H) Property or person directly affected
___Agency
___Recreationist
___Forest industry
___Permittee-Concessionaire
___Other:_____
___Contractor
___Public utility

(I) Consequences
___Clean-up work required
___Property damaged:_____
Property loss estimate: $_____
___Injuries (do not give tree values)
___Medical attention required
___Fatalities

(J) Name of site:_____
Comments:_____
_____

Only failures of a size capable of inflicting some damage or injury should be reported. Minor limb failures should not be reported unless they were potentially dangerous. Do not report simple death of a tree or part of a tree unless it resulted in mechanical failure. Trees removed prior to failure should not be reported.

Forest Service Form PSW-4600-3 (Rev. 6/75)

Section 5: Common Hazards of Tree Species Found in GNP

Alder (*Alder incana, A. sinuata*)

Principal hazards: Root loosening by water (Wagener 1963).

Quaking aspen (*Populus tremuloides*)

Principal hazards: Killed trees or tops (Wagener 1963).

Sporophores usually indicate decay that extends 5-6 feet above and below the conk. Aspen, because of their fragile bark, are especially susceptible to trunk injuries. Trees in developed recreation sites are often injured by visitors; such injuries often lead to infection by canker producing fungi. Cankers do not weaken trees structurally unless they are large or are infected by decay fungi. Increment cores might be necessary to define the amount of defect. However, cores should be taken only when necessary, as they produce wounds which might provide infection sites for canker and decay fungi. Also, cores taken from trees with internal decay provide new points from which existing decay can move into unaffected tissues formed since the decay process was initiated in the tree (Johnson 1981).

Black cottonwood (*Populus trichocarpa*)

Principal hazards: Cankers, heart and sap rots, undermined roots.

The wood of cottonwoods is soft and quite brash, as well as having little resistance to decay. Cottonwoods are also subject to several bark canker diseases that might be followed by decay. On this account they should be inspected at least annually for defects that could lead to breakage. Prompt action should be taken to remedy any potentially hazardous conditions found. Near streams the undermining of root systems during high water should be watched (Wagener 1963). The main defect of cottonwood is large dead or rotten branches. Large trees are sometimes rotten and the amount of sound wood should be measured on increment cores. Slime flux (foul-smelling and unsightly bleeding from wounds) and wet wood should not be confused with wood-rotting fungi. These indicators are common in hardwoods and usually do not indicate decay. Many river bottom trees are not windfirm because of the high water table and coarse soil structure (Johnson 1981).

Birch (*Betula glandulosa, B. occidentalis,* and *B. papyrifera*)

A range of environmental factors can cause bark splitting on branches and stems of birch trees. During the growth season if weather begins dry and if followed by rain (or some sort of wetting) splitting might occur due to excessive, quick growth. Fungi and bacteria infestations can lead to cankers forming on the bark of branches or main trunks of trees. This eventually leads to girdling of the branch or trunk, killing that part or the entire tree. Soil compaction, chemical injury, or unfavorable conditions (drought, poor soil) might cause the tree to show signs of leaf scorch.

Conifers

Alterations to natural disturbance regimes have caused a decrease in diversity of successional stages and vegetation types for conifers. Combined with changing climate, historic forest structure and plant species composition is changing across entire landscapes. Large-scale wildfires are occurring on more frequent intervals, leaving large amounts of dead and decaying wood to incubate various insects and diseases. Warmer, drier weather is facilitating insect and disease spread as larvae are not dying off in the winter and conifers are not a vigorous as they normally would be. Higher temperatures are also allowing insects and diseases to exist at higher elevations where trees are not capable (genetically resistant) to defend themselves against attacks. Animal damage from

porcupines, bears, ungulates, sapsuckers, to name a few, impacts all the conifers. Whether it's chewing, scratching, rubbing, shredding the bark and cambium, and browsing buds; these types of damage can be devastating to a tree. Dwarf mistletoes also infest nearly all native conifers in the region. Witches broom (abnormal proliferation of braches or twigs on a single branch) causes the tree to become top heavy or a single branch becomes too heavy and breaks off.

Lodgepole pine (*Pinus contorta*)

Lodgepole pine has thin bark which is easily damaged resulting in increased susceptibility to decay (Johnson 1981). Mountain pine beetle (*Dendroctonus ponderosae* Hopkins)leaves a very obvious pitch tube on the bark of the tree where is has entered and wood boring dust is present at the base of the tree. The insects feed on the phloem layer and sapwood until the tree is girdled. Blue stain fungi will also attach the tree at the same time clogging the water support system (phloem), eventually killing the tree. Large outbreaks of mountain pine beetle occur in lodgepole pine forest usually at lower elevations. Pine beetle engravers (*Ips pini*)can also infest a lodegpole pine stand. Tomentosus root disease (*Inonotus tomentosus* (Fr.) Teng.)causes typical crown symptoms and decay the heartwood. And fungi can cause stem decay (Hagel et al. 2003).

Ponderosa pine (*P. ponderosa*)

Stem damage from blister rust is noticeable by flagged (which means browning ends) branches that have cankers with rough bark present also. Stem damage might also occur from moths and cankers. Western pine beetle (*Dendroctonus brevicomis* LeConte) feed in phloem layer of inner bark as larvae and adults working their way out. This can cause girdling and eventually kills the tree. Boring dust can be noticed at the base of the tree but the pitch tubes are slight. Damage appears as that of mountain pine beetle but the galleries are different (Hagel et al. 2003).

Limber pine (*P. flexilis*)

Limber pine is host to many of the insect and disease that generalize on pine species. Damage can be identified by cankers, needle cast, flagging, and bark damage.

Western white pine (*P. monticola*) and Whitebark pine (*P. albicaulis*)

White pine blister rust (Cronartium ribicola Fisch.)is a fungus that alternates hosts between the five-needle pines and *Ribes* spp. such as gooseberries and currents. Cankers form on stems and branches eventually leading to top kill or death to most infected trees. The pines try to get rid of the fungus by pitching, therefore increased pitch and bark discoloration can identify an infestation. Branch flagging occurs after the canker has girdled the branch. Bright orange spores are released in spring.

Western and Alpine Larch (*Larix occidentalis, L. lyallii*)

Common hazard associated with larch trees are incurred from root disease, stem decay, and insect infestation. *Armellaria* root disease might attack several conifer species, including Larch especially if the age of the tree is less than 30 years. It is identified by a ring that forms around the root (root collar) which eventually girdles the tree and kills it. Once infected by the disease the tree becomes susceptible to insect attacks. Insects for larch bark beetles, wood borers and budmoths. Infestations can be identified by sloughing bark, boring dust at base of tree, pitch tubes or once the tree is almost dead or dead cankers can form.

Larch needle blight (*Hypodemella laricis* Tub.) and larch needle cast (*Meria laricis* Vuill.) are two foliage disease hosted only by Western Larch. Larch needle blight causes

needles to droop on branches turning red the first year and gray after that. Larch needle cast causes yellow spots which become red-brown; needles emerging in the spring are the first to get attacked. Seedlings are most affected by these two diseases but mature trees can be severely infected depending on weather conditions (Hagle et al. 2003)

Fir (*Abies lasiocarpa, A. grandis*)

Rot commonly occurs in over-mature spruce and true fir. Subalpine fir is particularly susceptible to decay fungi and the frequency and extent of rot increases markedly with age. Trunk wounds, punky knots, frost cracks, and broken tops often indicate decay in spruce and fir, whereas burls and cankers do not. Sporophores, when present, indicate advanced decay. When a defect is suspected, increment cores should be taken to confirm the presence of rot. Spruce and fir usually are not windfirm because of shallow root systems. Therefore any damage to the roots would increase the probability of windthrow. Rust brooms, unless large, are not a serious hazard. Both spruce and true firs are relatively tolerant of trunk damage, but once damage occurs they are very susceptible to decay (Johnson 1981).

Engelmann spruce (*Picea engelmanni*)

See Johnson's remarks for fir above.

Douglas-fir (*Pseudotsuga menziesii*)

Douglas-fir is susceptible to most insects and disease found in the Intermountain West. Western spruce budworm, mountain pine beetle, Douglas-fir beetle are increasing as the densities of Douglas-fir increase (Battaglia and Sheppard 2007). Damage can be identified by cankers, needle cast, flagging, and bark damage.

Western hemlock (*Tsuga heterophylla*)

Western hemlock is susceptible to wood boring beetles who generalize on conifers. Infestation of wood boring beetles can be identified by the build up of wood dust at the base of the tree. The Western hemlock looper (*Lambdina fiscellaria lugubrosa* (Hulst)) feeds mostly on foliage at the base of the needle which usually results in the needle falling off. An infestation can kill a tree in about one year as the worm does not discriminate between young and old foliage. An infestation can be identified by the presence of "inch worm" type larvae on the needles from June to August. And Tan-colored moths with two dark wavy lines on forewing and one on the hind wing are seen from September through October.

Western redcedar (*Thuja plicata*)

Cedar Laminated Butt Rot (*Phellinus weirii* (Murr.) *Gilbertson*) and Cedar Brown Pocket Rot (*Postia sericeomollis* (Rom.) *Julich*) are the two types of stem decay that infect Western redcedar. Butt rot forms in concentric circles starting at the crescents in the sapwood. Concentric circles separate easily into thin sheets. Fruiting bodies are rare; one must sound the tree to test for hollowness. Pocket Rot, also, shows no outward signs of infestation. Western redcedar is also susceptible to all insects and diseases that generalize on conifers.

Section 6: Example of Minimum Tool Analysis Work Sheet

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MIMNIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

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

– the Wilderness Act, 1964

Please refer to the accompanying MRDG *Instructions* for filling out this guide.

The spaces in the worksheets will expand as necessary as you enter your response.

Step 1: Determine if any administrative action is necessary.

Briefly describe the situation that may prompt action.

Dying or decaying trees pose an unnecessary risk to the public in designated campgrounds and to historic structures in the backcountry zone; a recognizable structural flaw identifies a tree as a potential risk and makes that tree, or part of a tree, a hazard.

To determine if administrative action is necessary, answer the questions listed in A - F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☒ **No:** ☐

Explain:
Visitors are expected to know that they must assume a substantial degree of risk and responsibility for their own safety. Recommended wilderness is managed as wilderness as directed by Director's Order #41 and 2006 NPS Management Guidelines. Glacier National Park has designated campgrounds in the wilderness to minimize and confine user impacts on wilderness. Each group receiving a Backcountry Use Permit should be given a thorough explanation of the backcountry safety hazards and inherent risks associated with backcountry travel and camping in Glacier. Much of this message is provided in Glacier's backcountry camping video. It is the park's responsibility to reduce the risks to visitors when using designated campgrounds. Historic backcountry structures are also protected and preserved in wilderness, according to 2006 NPS Management Guidelines and the National Historic Preservation Act.

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

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

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

Explain:

Reduction of risks to visitors, as described in section A, takes precedence over all other management actions as the Park Service strives to protect human life and provide for injury-free visits. NPS Management Guideline 8.2.5.1 Visitor Safety, recognizes 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; such as wilderness. That being said, when a park designates a campground for visitor use it is the park's responsibility to minimize potential hazards for visitors, this includes hazard tree treatment.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

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

Explain:
In keeping the spirit and direction the Nation is founded upon and reflected in its historical heritage, the National Historic Preservation Act strives to protect and preserve this irreplaceable heritage.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, tribal government agreements, state and local government and interagency agreements?

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

Explain:
See sections A and B.

E. Wilderness Character

Is action necessary to preserve the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

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

Explain: Not providing and maintaining designated campsites would encourage visitors to develop numerous campsites in multiple locations increasing impact to natural resources. Areas would be trampled by people and stock animals without regard to habitat, species, or natural processes.

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

Explain: The action would maintain developed campsites and historic structures in the wilderness. This is a sacrifice the park makes to uphold other wilderness characteristics. Hazard tree treatment actions would only occur at designated campgrounds and historic structures.

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

Explain: Naturalness would be preserved by removing hazard trees in designated campgrounds because visitors would continue to use these sites and not create their own without regard to natural processes and concerns.

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

Yes: ☐ **No:** ☐ **Not Applicable:** ☐ **No Change:** ☒

Explain: Preservation of outstanding opportunities for solitude or a primitive and unconfined type of recreation would not be impacted by the removal of hazard tree(s) as the tree would ultimately end

up falling on its own. Planned removal only reduces the risks to identified targets (such as visitors or historical structures) under controlled situations.

Other unique components that reflect the character of this wilderness:

Yes: ☐ **No:** ☐ **Not Applicable:** ☐ **No Change:** ☒

Explain: The extensive amount of acres of wilderness Glacier National Park provides (over 960,000 acres) would not be changed by the removal of a hazard tree(s). Glacier melt would not be influenced by the removal of hazard tree(s).

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain: Removal of a hazard tree(s) supports recreational opportunities in the wilderness. Though the visitor is expected to accept some inherent risks when participating in wilderness adventures, the park seeks to provide a safe and healthful environment in designated backcountry campgrounds.

Scenic: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☒

Explain: The removal of a hazard tree(s) would not interfere with the overall scenic quality the wilderness provides. Occasional use of a saw, whether hand held or chainsaw, would result in a stump which might cause visual impact to the visitor.

Scientific: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☒

Explain: The removal of a hazard tree(s) would not undermine the scientific value of wilderness in the park.

Education: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☒

Explain: The removal of a hazard tree(s) would not undermine the educational value of wilderness in the park.

Conservation: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain: Maintaining a designated campsite encourages overnight visitors to utilize one particular spot instead of creating numerous camp sites in multiple areas; conserving the surrounding, pristine habitats in the wilderness.

Historical use: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain: By removing hazard trees around historic structures, these structures would be preserved and maintained for future generations to enjoy.

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: ☒ **No:** ☐ **More information needed:** ☐

Explain: Hazard tree removal in designated campsites and around historic structures in the wilderness is necessary to reduce the risks to the public and heritage reasons.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying MRDG *Instructions* for an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative # 1: Remove the hazard tree by pushing the hazard tree over

Description:
This alternative would only be applicable to small uprooted trees or larger trees with a direct and safe fall path. The identified hazard tree would have to be easily pushed over in order for this alternative to be viable.

Effects:

Wilderness Character

"Untrammeled" – Hazard trees would only be identified around historic buildings and in and around designated campsites. Removal of an identified hazard tree would encourage visitors to utilize designated campgrounds versus creating multiple new sites.

"Undeveloped" – Maintaining a designated campsite is a development the park is willing to sacrifice in order to preserve the character and value in the rest of the wilderness. This alternative would minimize the presence of human's work as no stump would remain and the hazard tree would look as though it fell naturally.

"Natural" – Naturalness of the wilderness would be preserved by removing hazard trees in designated campgrounds because visitors would continue to use these sites and not create their own without regard to natural processes and resource concerns.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Opportunities for visitors to experience solitude or a primitive and unconfined type of recreation would be protected under this alternative as the only disruption would be in the form of a noise as the tree fell. The sound would be natural as though the tree fell by itself and would not spoil the visitors' experience.

Heritage and Cultural Resources – Identified hazard trees around historic structures in the wilderness would be felled in order to prevent the structure from being damaged. Thus the historic structure would be preserved for future visitors to enjoy.

Maintaining Traditional Skills – Pushing a hazard tree down is the most primitive tool available for the task. It requires no extra weight, tools or supplies and is therefore the most proficient tool available as well.

Special Provisions – Under this alternative there is no need to have special provisions as the tool being use is primitive and non-motorized.

Safety of Visitors, Personnel, and Contractors – Allowing a hazard tree to remain would pose an unnecessary risk to visitors, personnel, and contractors. Using the push method of tree removal can be hazardous if the tree is too large or has other hazardous contraints associated with it.

Economic and Time Constraints – This alternative can be implemented on a need be basis and requires no additional tools or supplies, therefore it is the most economical alternative. However, it can only be applied in cases where the tree is small enough or weakened with a safe fall line so implementation of this alternative exclusively would be rare.

Additional Wilderness-specific Comparison Criteria This alternative would have no consequences on the glaciers in the park.

Alternative # 2: Remove the hazard tree by using a winch

Description:
Identified hazard tree(s) would be felled by using a winch to pull the entire tree or part of the tree down to the ground.

Effects:

Wilderness Character

"Untrammeled" – Hazard trees would only be identified around historic buildings and in and around designated campsites. Removal of an identified hazard tree would encourage visitors to utilize designated campgrounds versus creating multiple new sites.

"Undeveloped" – Maintaining a designated campsite is a development the park is willing to sacrifice in order to preserve the character and value in the rest of the wilderness. This alternative would

minimize the presence of human's work as no stump would remain and the hazard tree would look as though it fell naturally.

"Natural" – Naturalness of the wilderness would be preserved by removing hazard trees in designated campgrounds because visitors would continue to use these sites and not create their own without regard to natural processes and resource concerns.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Opportunities for visitors to experience solitude or a primitive and unconfined type of recreation would be protected under this alternative as the only disruption would be in the form of a noise as the tree fell. The sound would be natural as though the tree fell by itself and would not spoil the visitors' experience.

Heritage and Cultural Resources
Identified hazard trees around historic structures in the wilderness would be felled in order to prevent the structure from being damaged. Thus the historic structure would be preserved for future visitors to enjoy.

Maintaining Traditional Skills

Though a winch is a non-motorized tool, it is still mechanical.

Special Provisions
Under this alternative there is no need to have special provisions as the tool being use is non-motorized.

Safety of Visitors, Personnel, and Contractors
Allowing a hazard tree to remain would pose an unnecessary risk to visitors, personnel, and contractors. Using the winch to fell a tree can be hazardous if the tree is too large, severly decayed or there is not a safe place to anchor.

Economic and Time Constraints
This alternative can be implemented on a need be basis but would require the operator to carry additional tools that are not necessary for any other task that might be also assigned when in the wilderness.

Additional Wilderness-specific Comparison Criteria
This alternative would have no consequences on the glaciers in the park.

Alternative # 3: Use a handsaw to remove the hazard tree

Description:
This alternative would utilize a handsaw to fell the tree identified as a hazard tree from designated campgrounds and historic structures.

Effects:

Wilderness Character

"Untrammeled" – Hazard trees would only be identified around historic buildings and in and around designated campsites. Removal of an identified hazard tree would encourage visitors to utilize designated campgrounds versus creating multiple new sites.

"Undeveloped" – Maintaining a designated campsite is a development the park is willing to

sacrifice in order to preserve the character and value in the rest of the wilderness. This alternative would show the presence of human's work as a stump would remain.

"Natural" – Naturalness of the wilderness would be preserved by removing hazard trees in designated campgrounds because visitors would continue to use these sites and not create their own without regard to natural processes and resource concerns.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Opportunities for visitors to experience solitude or a primitive and unconfined type of recreation would be protected under this alternative as the only disruption would be in the form of a noise as the tree fell.

Heritage and Cultural Resources
Identified hazard trees around historical structures in the wilderness would be felled in order to prevent the structure from being damaged. Thus the historic structure would be preserved for future visitors to enjoy.

Maintaining Traditional Skills

Utilizing a handsaw to fell a hazard tree maintains traditional skills by operating a non-motorized, primitive tool.

Special Provisions
Under this alternative there is no need to have special provisions as the tool being use is primitive and non-motorized.

Safety of Visitors, Personnel, and Contractors
Allowing a hazard tree to remain would pose an unnecessary risk to visitors, personnel, and contractors. Using a handsaw to fell a hazard tree can be dangerous to the sawyer if the tree is too large or has other hazardous contraints associated with it. Falling certification cources are only available for chainsaw fellers.

Economic and Time Constraints
This alternative requires the operator of the saw to be proficient and skilled with a handsaw, whether it is a cross-cut or some other type of handsaw.

Additional Wilderness-specific Comparison Criteria
This alternative would have no consequences on the glaciers in the park.

Alternative # 4: Use explosives to remove the hazard tree

Description:
This alternative would use explosives to fell an identified hazard tree from the vicinity of a designated campground or a historic structure in the wilderness.

Effects:

Wilderness Character
"Untrammeled" – Hazard trees would only be identified around historic buildings and in and around designated campsites. Removal of an identified hazard tree would encourage visitors to utilize designated campgrounds versus creating multiple new sites.

"Undeveloped" – Maintaining a designated campsite is a development the park is willing to sacrifice in order to preserve the character and value in the rest of the wilderness. This alternative would

minimize the presence of human's work as no stump would remain.

"Natural" – Naturalness of the wilderness would be preserved by removing hazard trees in designated campgrounds because visitors would continue to use these sites and not create their own without regard to natural processes and resource concerns.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Opportunities for visitors to experience solitude or a primitive and unconfined type of recreation would be protected under this alternative as the only disruption would be in the form of a noise as the explosive went off. The sound would be loud and widespread and might spoil the visitors' experience for a short time.

Heritage and Cultural Resources
Identified hazard trees around historic structures in the wilderness would be felled in order to prevent the structure from being damaged. Thus the historic structure would be preserved for future visitors to enjoy.

Maintaining Traditional Skills
Blasting or use of explosives is considered a traditional tool and skill. This alternative would maintain the traditional skill of blasting and use of a primitive tool.

Special Provisions
The tool would only be used when deemed appropriate and feasible for the particular site. Only certified personnel would conduct this form of treatment.

Safety of Visitors, Personnel, and Contractors
Allowing a hazard tree to remain would pose an unnecessary risk to visitors, personnel, and contractors. Using explosives as a method of tree removal can be hazardous to the operator if they are not trained appropriately.

Economic and Time Constraints
This alternative is more expensive than the other alternatives and would be implemented on rare occasions.

Additional Wilderness-specific Comparison Criteria
This alternative would have no consequences on the glaciers in the park.

Alternative # 5: Use a chainsaw to remove the hazard tree

Description:
This alternative would use chainsaws to fell an identified hazard tree from the vicinity of a designated campground or a historic structure in the wilderness.

Effects:

Wilderness Character

"Untrammeled" – Hazard trees would only be identified around historic buildings and in and around designated campsites. Removal of an identified hazard tree would encourage visitors to utilize designated campgrounds versus creating multiple new sites.

"Undeveloped" – Maintaining a designated campsite is a development the park is willing to sacrifice in order to preserve the character and value in the rest of the wilderness. This alternative would

show the presence of human's work as a stump would remain.

"Natural" – The use of a chainsaw would result in a less natural condition for a brief period while the saw is being operated. However, the naturalness of the wilderness would be preserved by removing hazard trees in designated campgrounds because visitors would continue to use these sites and not create their own without regard to natural processes and resource concerns.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Opportunities for visitors to experience solitude or a primitive and unconfined type of recreation would be decreased under this alternative as disruption would occur in the form of a noise as the chainsaw is operating and as the tree fell.

Heritage and Cultural Resources
Identified hazard trees around historic structures in the wilderness would be felled in order to prevent the structure from being damaged. Thus the historic structure would be preserved for future visitors to enjoy.

Maintaining Traditional Skills
The use of a chainsaw decreases the contrast between wilderness and other lands and does not contribute to maintaining traditional tool skills.

Special Provisions
As stated in section 4 (c) of the Wilderness act, "measures required in emergencies to involving the health and safety of person within the area" are an exception to prohibition of certain uses, that includes motorized equipment.

Safety of Visitors, Personnel, and Contractors
Allowing a hazard tree to remain would pose an unnecessary risk to visitors, personnel, and contractors. Using a chainsaw to fell a tree can be hazardous if the operator is not properly trained or wearing the appropriate personal protective equipment, especially on rugged, uneven terrain.

Economic and Time Constraints
This alternative would be implemented when the identified hazard tree is too large and unstable for other tools available. Chainsaw work for hazard trees could be executed along with trail maintenance saving time and reducing personnel needs.

Additional Wilderness-specific Comparison Criteria
This alternative would have no consequences on the glaciers in the park.

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG *Instructions* before describing the selected alternative and describing the rationale for selection.

Selected alternative:
This decision step would be completed on an individual basis for each situation where a hazard tree(s) has been identified.

Rationale for selecting this alternative:
The best alternative would be selected based on tree size and level of decay or hazard, target,

complexity of the situation, availability of a certified sawyer, availability of a certified explosives expert, and tools on hand.

Monitoring and reporting requirements:
Monitoring would be completed as part of the *Hazard Tree Management Plan*, please refer to that yearly report.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☐ mechanical transport
- ☐ motorized equipment
- ☐ motor vehicles
- ☐ motorboats
- ☐ landing of aircraft
- ☐ temporary road
- ☐ structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:				
Recommended:				
Recommended:				
Approved:				

ALTERNATIVES CONSIDERED BUT REJECTED

The alternative of cutting down all dead or dying trees in developed areas and backcountry campgrounds and around historic structures throughout the park was considered but rejected because it would be in opposition to the park mandate to protect natural resources. Not conducting hazard tree treatment in the park and allowing them to fall naturally was also considered but rejected due to threats to people, structures and vehicles.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969 (NEPA), which is guided by the Council on Environmental Quality (CEQ). The CEQ provides direction that the "environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA Section 101":

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all generations safe, healthful, productive, and esthetically 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 that 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.

Both the No Action Alternative and the Preferred Alternative would fulfill criteria 1, 2, 3, and 4 by providing a proactive plan for reducing the risk to personal safety and historic resources caused from hazard trees. Neither alternative specifically addresses criteria 5, though they do not conflict with it. The Preferred Alternative provides more options for using trees that have been removed to benefit other park programs when in the past trees were most often burned at the dump. Therefore, the Preferred Alternative better fulfills criteria 6 and is the Environmentally Preferred Alternative.

Table 5. Summary of impacts of each alternative on selected resources

Impact Topic	No-Action Alternative	Preferred Alternative
Vegetation	Minor long-term local adverse effects including unmitigated lower tree densities in developed areas and temporary trampled vegetation	Minor temporary local adverse effects from temporary loss of trees and trampled vegetation
Wildlife	Minor to moderate long-term local adverse effects due to unmitigated loss of trees in developed areas	Minor long-term local adverse effects due to loss of trees in developed areas in all the management zones.

Impact Topic	No-Action Alternative	Preferred Alternative
TES – Grizzly bear	Minor, temporary, local and adverse effects from artificial noise and increased human activity	Minor, temporary, local and adverse effects from artificial noise and increased human activity
Ethnographic Resources	Minor long-term local adverse effects if a culturally-scarred tree requires topping	Minor long-term local adverse effects if a culturally-scarred tree requires topping
Public Health and Safety	Moderate long-term local beneficial effects in visitor service, rustic and day use zones from active hazard tree management and moderate long-term local adverse effects in the backcountry zone where systematic surveys would not be conducted	Moderate long-term local beneficial effects from implementing proactive hazard tree management in all the management zones
Recommended Wilderness	Negligible to minor, adverse and beneficial, long-term and localized impacts would be imposed on wilderness values as a result of stumps, noise, increased sunlight to the ground in and around designated campsites and historic buildings.	Negligible to minor, adverse and beneficial, long-term and localized impacts would be imposed on wilderness values as a result of stumps, noise, increased sunlight to the ground in and around designated campsites and historic buildings.

AFFECTED ENVIRONMENT / ENVIRONMENTAL CONSEQUENCES

METHODOLOGY

The condition within the park of each resource topic chosen for impact analysis is described. The effects of each alternative are then assessed for direct, indirect, and cumulative impacts on these resources. Potential impacts are described in terms of type (are the effects beneficial or adverse?), context (are the effects site-specific, local, or regional?), duration (are the effects short-term or long-term?), timing (is the project seasonally timed to avoid adverse effects?), and intensity (are the effects negligible, minor, moderate, or major?). Because definitions of intensity vary by the resource, intensity definitions are provided in Table 5 for each impact topic analyzed in this EA.

IMPAIRMENT OF PARK RESOURCES OR VALUES

National Park Service Management Policies (NPS 2006a) require analysis of potential effects to determine whether or not actions would impair park resources or 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. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, actions that would adversely affect park resources and values.

These laws give the National Park Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that the National Park Service must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value might constitute as impairment. Impairment might result from NPS activities in managing the park, from visitor activities, or from activities undertaken by concessionaires, contractors, and others operating in the park. An impact would be more likely to constitute as impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- Identified as a goal in the park's *General Management Plan* or other relevant NPS planning documents.

Each alternative was analyzed to determine if impacts constituted an impairment to park resources and values.

CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for both the No Action and Preferred alternatives.

Cumulative impacts were determined by combining the impacts of the Preferred Alternative with other past, present, and reasonably foreseeable future actions. Hazard tree management actions would primarily be conducted in developed areas where potential targets are most common and consist of the removal of dead or dying trees. Other projects in developed areas that could result in the removal of snags and that have the potential to have a cumulative effect in conjunction with the Preferred Alternative include:

Actions within Glacier National Park:

- Rehabilitation of the Going-to-the-Sun Road including new transit center (2004-2012): Rehabilitation includes repairs to historic retaining walls, guardwalls, tunnels, and other structural features contributing to the historic character of the road as well as associated mitigation measures such as a new transit center.
- Construction projects in developed areas proposed in *Commercial Services Plan* (NPS 2004b): includes disturbing 14.5 acres with various tree densities and species.

- Mechanical fuel reduction in developed areas for fire protection (ongoing).

Actions outside of Glacier National Park:

- Logging on adjacent federal and private land
- Development on adjacent land

IMPACTS TO CULTURAL RESOURCES AND SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT

In this environmental assessment, impacts to cultural resources are described in two ways. The first is in terms of type, context, duration, and intensity, which is consistent with the regulations of the Council on Environmental Quality (CEQ) that implement the National Environmental Policy Act (NEPA). The second is in accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 of the NHPA (36 CFR Part 800, Protection of Historic Properties). Impacts to historic properties were identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that were either listed in or eligible to be listed in the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed in the National Register; and (4) considering ways to avoid, minimize or mitigate adverse effects.

Under the Advisory Council's regulations a determination of either adverse effect or no adverse effect must be made for affected National Register eligible cultural resources. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualify it for inclusion in the National Register (e.g. diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the preferred alternative that would occur later in time, be farther removed in distance or be cumulative (36 CFR Part 800.5, Assessment of Adverse Effects). A determination of no adverse effect means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion in the National Register.

CEQ regulations and the National Park Service's *Conservation Planning, Environmental Impact Analysis and Decision-making* (Director's Order #12) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g. reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Although adverse effects under Section 106 might be mitigated, the effect remains adverse.

A Section 106 summary is included in the impact analysis section under the preferred alternative for ethnographic resources. The Section 106 Summary is not intended to meet the requirements of Section 106 since in the unusual instance that a culturally scarred tree is found to be a hazard tree, additional consultation with the CSKT and SHPO would occur.

Table 6. Impact threshold definitions and duration.

Impact Topic	Negligible	Minor	**Moderate**	Major	Duration
Vegetation	Vegetation would not be affected or the changes would be so slight that they would not be of any measurable or perceptible consequence to the species' population.	Some individual native plants would be affected over a relatively small area, but the effects would be localized, and would be of little consequence to the species' population.	Individual native plants would be affected over a relatively wide area or multiple sites and would be readily noticeable. A sizeable segment of the species' population could be affected.	A considerable effect on native plant populations would occur over a relatively large area.	Short term—Effects last less than 3 years. Long term—Effects last more than 3 years.
Wildlife	Wildlife species would not be affected or the changes would be so slight that they would not be of any measurable or perceptible consequence to the species' population.	Effects to individual wildlife and species of concern are possible, although the effects would be localized, and would be of little consequence to the species' population.	Effects to individual wildlife and species of concern are likely, and a sizeable segment of the species' local population could be affected.	Effects to wildlife and species of concern would have substantial consequences to species populations in the region.	Short term—Effects extend only through the period of the project. Long term—Effects extend beyond the project period.
Threatened and Endangered Species	No listed species would be affected or an individual of a listed species, or its critical habitat, would be affected, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population. Impact would equate with a "no effect" determination in USFWS terms.	An individual(s) of a listed species or its critical habitat would be affected, but the change would be small. Minor effect would equate with a "may affect, not likely to adversely affect" determination for the species in U.S. Fish and Wildlife Service terms.	An individual or population of a listed species, or its critical habitat would be noticeably affected. Moderate effect would equate with a "may affect" determination in U.S. Fish and Wildlife Service terms and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species.	An individual or population of a listed species, or its critical habitat, would be noticeably affected with a vital consequence to the individual, population, or habitat. Major effect would equate with a "may affect, likely to adversely affect" determination in USFWS terms and would require formal consultation.	Short term—Effects extend only through the period of the project. Long term—Effects extend beyond the project period.

Impact Topic	Negligible	Minor	**Moderate**	Major	Duration
Ethnographic Resources	Impact(s) would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices. There would be no change to a group's body of beliefs and practices. For purposes of Section 106, the determination of effect on would be no adverse effect.	Impact(s) would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices. For purposes of Section 106, the determination of effect would be no adverse effect.	Impact(s) would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's beliefs and practices, even though the group's beliefs and practices would survive. For purposes of Section 106, the determination of effect would be adverse effect.	Impact(s) would alter resource conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of beliefs and practices, to the extent that the survival of a group's beliefs and/or practices would be jeopardized. For purposes of Section 106, the determination of effect would be adverse effect.	Short term—Effects extend only through the period of the project. Long term—Effects extend beyond the project period.
Public Health and Safety	Public health and safety would not be affected, or the effects would not be noticeable.	The effect would be detectable, but would not have an appreciable effect on public health and safety.	The effects would be readily apparent, and would result in a substantial change in public health and safety in a manner noticeable to staff and the public.	The effects would be readily apparent, would result in a substantial change in public health and safety in a manner noticeable to staff and the public, and be markedly different from existing operations.	Short-term - Effects lasting for the duration of the project Long-term - Effects lasting longer than the duration of the project.
Recommended Wilderness	Wilderness would not be affected or the effects would not be measurable.	The effect on wilderness would be detectable, but would be slight and localized.	The effects would be readily apparent, and would result in a substantial change to the localized wilderness landscape that would be noticeable to the public.	The effects would be highly apparent and would change the character of the wilderness area.	Short-term – Effects persist for one year or less Long-term – Effects persist for more than one year or are permanent

Vegetation

The vegetation of Glacier National Park falls into four broad geographic patterns: arctic-alpine, northern coniferous forest (boreal), western montane (cordilleran), and Great Plains (Lesica 2002). In the northern Rockies, the Continental Divide is the boundary between the semi-arid continental climate of the Great Plains and the temperate maritime climate of the northern Rocky Mountains to the west. Glacier National Park is located along the main chain of the Rocky Mountains in the middle of the western montane region and just southwest of the northern coniferous region, and the park's vegetation is dominated by species typical of those regions. Western montane species are found at all elevations in all habitats, while northern coniferous species are in forests and wetlands, and arctic-alpine plants occur mainly above treeline. There are only a few Great Plains species along the east edge of the park where the sharp rise of the mountains brings more precipitation. The meeting of the four regions causes many species to be at the limits of their distribution in the park.

The park supports over 1,100 species of vascular plants (Lesica 2002) and at least 870 non-vascular plants (DeBolt and McCune 1993, Hermann 1969, Elliott 1987). Large-scale climatic influences and the variety of environmental conditions in the park promote vegetation diversity. In addition, local climate that changes with elevation and proximity to mountain ridges or large bodies of water affects vegetation. The steep, variable terrain, ranging from approximately 3,200 to 10,500 feet, has clear contrasts in temperature and precipitation over relatively short distances. Fire, glaciation, and other geologic processes have also influenced the distribution of vegetation and led to the isolation of some species.

Types of vegetative land cover in the park include: dry herbaceous, (plants and shrubs that grow in dry areas — approximately 77,067 acres); mesic herbaceous (plants and shrubs that grow in wet areas, including riparian areas — approximately 48,821 acres); deciduous trees and shrubs (64,924 acres); coniferous forests and dense mesic areas (334,943 acres); coniferous forest and open dry areas (160,744 acres); and barren rock, snow and ice (298,357 acres).

Major types of vegetation communities are grasslands (dry herbaceous), pine or woodland savannahs (open, dry coniferous and deciduous), bottomland forests (mesic herbaceous and deciduous), ponderosa pine/Douglas fir (*Pinus ponderosa/Pseudotsuga menziesii*) forests (open, dry coniferous), western red cedar/western hemlock (*Thuja plicata/Tsuga heterophylla*) forests (dense, mesic coniferous), spruce/fir forests (dense, mesic coniferous land cover) and alpine communities (mesic herbaceous and barren). Other communities include marshes, swamps and lakes, and barren, rocky talus slopes (Habeck 1970). Although these latter habitats cover only a small area in the park, they are an important component of the park's diversity and contain many species of special concern.

The following sections describe the tree communities within the different management subdistricts in the park with specific detail to developed areas where hazard tree removal actions are most likely to occur.

Going-to-the-Sun Road Corridor
On the west side of the Going-to-the-Sun Road corridor, the vegetation in the Lower McDonald Valley is dominated by several successional stages of the moist western red cedar-western hemlock forest type. Since red cedar and hemlock do not establish quickly in recently opened stands, areas that have had more recent fires are comprised mostly of pioneering species, such as lodgepole pine, western larch, aspen, paper birch and black cottonwood. As the forests mature, Douglas fir, western larch, Engelmann spruce and western white pine begin to dominate the overstory in different proportions. Western hemlock and western red cedar

mostly grow in late seral and old growth stands that are often centuries old. Subalpine fir grows in several successional stages, while scattered grand fir grow only in later-seral forests. Also in the McDonald Valley, riparian vegetation dominates bottomland areas along lakes, rivers, and streams. Western red cedar, Engelmann spruce, and white spruce are often found with black cottonwood.

On the east side of the Going-to-the-Sun Road corridor, the vegetation in the St. Mary Valley is a mix of coniferous forest, deciduous forest, and grassland. Along the eastern border of the valley, aspen groves and grasslands form extensive parklands. Aspen sometimes mixed with black cottonwood, Engelmann spruce, lodgepole pine, and Douglas fir, extends along the lowslope and toeslopes above St. Mary Lake, particularly along the eastern end.

At lower elevations in the St. Mary Valley, Douglas fir usually grows in the warm, dry exposures, forming a mosaic pattern of vegetative communities with Engelmann spruce-subalpine fir. Douglas fir forests are on the dry mid-slopes, often mixed with lodgepole pine, subalpine fir, Engelmann spruce and limber pine. Engelmann spruce and subalpine fir grow on the lower moist slopes above St. Mary Lake, often with lodgepole pine and sometimes with black cottonwood and aspen.

The Apgar area is heavily forested and relatively flat in comparison with the surrounding area. The most common habitat type in this area is western red cedar or western hemlock. Because the area burned in a 1929 fire, a large portion of the present vegetation in the Apgar area is an early successional forest. Lodgepole pine and a few scattered western larches create a dense overstory with a large amount of Engelmann spruce regenerating in the understory. Black cottonwood and paper birch grow in forest openings. In spite of past disturbance, the forest that is closer to the buildings in the Apgar Village area is a midseral western red cedar/western hemlock community. There are large clusters of western red cedar scattered around the buildings, mixed with larger Douglas fir, Engelmann spruce, lodgepole pine and western white pine. Black cottonwood, paper birch, and lodgepole pine only dominate in areas that have had the heaviest use.

The Lake McDonald developed area is also in a western red cedar habitat type. A mature, 230-year old forest surrounds the area (Barrett 1997) and is dominated by very large western red cedar (16 to more than 22 inches in diameter at breast height) mixed with large western larch, western white pine, and Douglas fir. There are numerous old-growth black cottonwood trees (20 to 30 inches diameter at breast height) on the edge of this forest near the southern access road. Forest buffers between the Lake McDonald developed area and Going-to-the-Sun Road have been preserved. East of the Post Office, the forest is mainly western larch with scattered lodgepole pine, Douglas fir, and Engelmann spruce. Near the Post Office, there are more black cottonwood and paper birch trees.

Two Medicine

At lower elevations, most of the Two Medicine Valley is dominated by coniferous forest that includes lodgepole pine, subalpine fir, Engelmann spruce, and Douglas fir. Limber pine grows occasionally in more open stands. These areas are in various subalpine fir habitat types at several stages of succession. Quaking aspen stands, often mixed with black cottonwood, are the dominant vegetation near the eastern border of the park along Two Medicine Lake and are sometimes interspersed in the coniferous forest.

Riparian vegetation is common in low elevations along Two Medicine Creek, Appistoki Creek, and along the various lakes and smaller streams. Overstory trees in these areas are mainly Engelmann spruce, black cottonwood, quaking aspen and paper birch. Vegetation along the

upper slopes is subalpine fir, Engelmann spruce, lodgepole pine, and whitebark pine, with occasional Douglas fir and quaking aspen.

Vegetation in the Two Medicine developed area is comprised mainly of subalpine fir forest types. Parts of this area, particularly east of the ranger station and south of Appistoki Creek, are dense forest dominated by subalpine fir, lodgepole pine, and Engelmann spruce with occasional Douglas fir, limber pine, and whitebark pine. Much of the area near the campground, picnic area and other structures supports an open canopy forest because of these developments. Lodgepole pine, subalpine fir, Engelmann spruce, black cottonwood and aspen are only scattered throughout the area.

Many Glacier
The changing glaciation in the Many Glacier Valley has created diverse vegetation in the area. On the valley floor, subalpine fir habitat types, or climax forests, generally dominate the lower montane forest. The current overstory is a mix of subalpine fir, Engelmann spruce, lodgepole pine, and occasional Douglas fir. There are wetter pockets of aspen and black cottonwood throughout this area, and moist Engelmann spruce forests in depressions. Riparian areas are also scattered throughout the montane zone that contain Engelmann spruce and willows. At higher elevations, lodgepole pine, subalpine fir, Engelmann spruce and some aspen dominate the overstory. Near the treeline and along ridges, whitebark pine is also common.

Most of the vegetation around the Many Glacier Hotel and associated outbuildings is lodgepole pine and subalpine fir with scattered Engelmann spruce, black cottonwood and aspen in the overstory. The forest near the developments tends to be denser east and south of the hotel. There are only a few scattered trees to the north of the hotel, with mainly young black cottonwood in the overstory.

Southeast of the hotel, small aspen groves grow with a moister understory. There are more aspen groves near the rocky ridge east of the hotel. Wetland and riparian vegetation grows on the shores of Swiftcurrent Lake and Governor's Pond. Lodgepole pine and Engelmann spruce tend to dominate the overstory, while willows, alder, cattail, and sedges are common understory species.

The majority of the Swiftcurrent developed area is a dense wood of seral lodgepole pine, interspersed with black cottonwood, quaking aspen, subalpine fir, Engelmann spruce, and Douglas fir.

Goat Haunt-Belly River
The Goat Haunt Valley is mainly coniferous forest, most of which is in the subalpine fir habitat type. Subalpine fir and Engelmann spruce dominate later seral forests, while lodgepole pine, Douglas fir, Engelmann spruce, western larch, black cottonwood, quaking aspen, and paper birch are components of younger forests. Wetter spruce forests along lakes and streams and dry Douglas fir dominated areas on steep rock outcrops are interspersed in the spruce/fir forest.

In contrast, the Belly River Valley is a mix of deciduous forest, coniferous forest, grassland, and riparian communities. On the eastern border, the vegetation is mainly a mixed aspen/conifer forest. Quaking aspen and lodgepole pine dominate the overstory with scattered Engelmann spruce and subalpine fir. Willows dominate along the Belly River floodplain, sometimes mixed with black cottonwood, spruce, and aspen. Moist coniferous forest throughout the rest of the Belly River Valley generally dominates the area with lodgepole pine, Engelmann spruce, subalpine fir and Douglas fir in the overstory. Black cottonwood, aspen, and paper birch are in younger forests, and along larger streams and lakes throughout the valley.

In both valleys, as elevation increases, subalpine fir, Engelmann spruce, lodgepole pine, whitebark pine and sometimes limber pine and alpine larch dominate the forests.

Middle Fork
The Middle Fork area is covered mostly with a dense forest of even-aged stands initiated by fire, which consist of lodgepole pine and western larch (Barrett 1986). The potential climax species in this area are Engelmann spruce and subalpine fir, but frequent fires have limited their distribution. There are pockets of western red cedar-western hemlock habitat types in cool, moist sites along tributaries of the Middle Fork between Lincoln Creek and Nyack Creek. Douglas fir, black cottonwood, and paper birch are also scattered throughout the area. The vegetation at higher elevations is a cooler coniferous forest with an overstory of subalpine fir, Engelmann spruce, lodgepole pine and occasional Douglas fir and whitebark pine.

Riparian and wetland vegetation grows along the Middle Fork of the Flathead River, numerous lakes in the Middle Fork Valley, and streams and creeks. Vegetation mainly includes black cottonwood, Engelmann spruce, paper birch, and aspen in the overstory.

Impact Analysis - Vegetation

No Action Alternative
Between 1994 and 2004 a total of 2,503 hazard trees were removed or topped through the hazard tree management program, mostly within developed areas. However, this number also includes some trees removed along roads which were previously the responsibility of the hazard tree crew. In the past four years an average of 127 hazard trees were treated annually. This is probably a better estimate of the number of trees that would be cut in future years because of current management practices. Forested areas comprise approximately 57% of the park and developed areas comprise less than 1% of the total park area. The small number of hazard trees treated annually is of little consequence to the population of any tree species in the park. As long as there is continued recruitment of new trees and succession forest processes are unimpeded then the continual removal of hazard trees should not be noticeable over the long-term in the park. Within developed areas the continual removal of trees could be noticeable, but can be mitigated for by planting young trees. Under this alternative, hazard tree treatment actions would not occur in the backcountry zone.

The treatment of hazard trees can also impact surrounding vegetation by removing shade and exposing other plants to sun and wind. However, most hazard trees are snags and lack considerable foliage which greatly reduces the shade or shelter they can provide. During treatment activities some vegetation adjacent to the hazard trees are trampled but this adverse impact is temporary. Currently, there are no protocols for planting young trees in areas where hazard trees have been removed which could result in long-term declines in tree densities at some locations. Overall, the impact to native vegetation in the park would be local, long-term, minor, and adverse.

Cumulative Effects. Other projects that result in tree removal in the park such as fuel reduction and removal of trees for new structures are minor and localized in scope. However, many of these activities would occur in the same areas as hazard tree program actions, primarily developed areas. Cumulatively, these actions would not produce a noteworthy decline of any tree species but could result in a lack of trees in developed areas. Without deliberate planting of young trees this impact could be long-term, local, moderate, and adverse. Actions such as logging that might occur on adjacent lands outside the park would be conducted at a larger scale than hazard tree management and focus on live trees. Cumulative impacts from hazard tree management in the park would be negligible on adjacent lands.

Preferred Alternative

In most cases, trees requiring removal in order to reduce risks are dead. Consequently, few live trees are felled in a given year. In the past four years, an average of 127 hazard trees were treated annually. This is probably a good estimate of the number of trees that would be cut in future years because of current management practices. Hazard tree management is not expected to diminish a species or population of tree present in the park. The vegetation in the immediate vicinity of a hazard tree might be trampled during removal activities, but the impacts would be very localized and temporary. A slight increase in the number of trees treated in the backcountry zone could occur, but this increase would be minor. If an area such as a designated campground in the backcountry zone were to lose a considerable portion of its trees, then young trees would be planted to mitigate for this decline. Overall, the impact to native vegetation in the park would be **local, temporary, minor, and adverse**.

Cumulative Effects. Cumulative effects would be similar as those for the No Action Alternative, moderate, long-term, local and adverse in developed areas but would include all management zones of the park.

Conclusion for Both Alternatives.

Overall, the effects of the No Action Alternative on vegetation in the park are local long-term minor adverse. The effects could be long-term because there are no current protocols for planting new trees after hazard tree removal actions resulting in a continued decline of tree cover in some areas. The Preferred Alternative would result in minor local temporary adverse impacts to park vegetation. Cumulative effects under both alternatives would be moderate long-term local adverse in developed areas but the Preferred Alternative would also include the backcountry management zone.

Because there would be no major, adverse impacts to vegetation resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation and proclamation of Glacier National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's *General Management Plan* or other relevant National Park Service planning documents, there would be no impairment of the park's resources or values.

Wildlife

Over 300 species of terrestrial wildlife occupy Glacier National Park, either seasonally or year-round. The vegetation descriptions above also describe wildlife habitat in the park. Riparian areas, travel routes, avalanche chutes, shrubfields, wetlands, meadows, bogs, snags, recently burned areas, aspen parklands, old-growth forests, floodplains, mineral licks, nesting colonies, birthing grounds, hibernacula, den sites, ecotonal areas, roosts, caves, and cliffs are especially significant to many species of wildlife.

The following sections describe the primary wildlife species and habitats present within each management subdistrict in the park with particular emphasis on developed areas where hazard tree management would be concentrated. A section with a more specific description of bald eagle habitat and use in the park follows.

Going-to-the-Sun Road Corridor

The McDonald Valley is unique because it is the widest and deepest valley of any tributary on the west side of the park, and Lake McDonald is the largest lake in the park. Although the climate of this area is a modified north Pacific coast type, topographical influences, including valley-ridge configurations, elevation, lake effect, aspect and exposure, combine to create extreme variations in weather over short distances and consequently, a variety of wildlife

habitats (Kuchel 1977). There is year-round habitat for many species of wildlife in the valley, including moose, elk, mule and white-tailed deer, black and grizzly bear, cougar, lynx, fisher, wolverine, and marten. There is ungulate winter range in the McDonald Valley and along the Middle Fork of the Flathead River. The inlets of Lake McDonald and adjacent areas provide important breeding, foraging, roosting, and wintering habitat for resident and migrant bald eagles. The McDonald Valley also contains nesting habitat for golden eagles, osprey, pileated woodpeckers, and barred owls. Upper McDonald Creek, above the inlet of Lake McDonald, has been identified as the single most important harlequin duck-breeding stream in Montana (Ashley 1998); and Lake McDonald is also an important area for common loons and numerous other waterfowl.

There is a major wildlife travel corridor between Apgar and West Glacier. Black bear, grizzly bear, elk, deer, mountain lion, lynx, and pine marten have all been observed in this area. Elk use the Apgar area in spring for calving and foraging. Muskrat, beaver, mink, river otters, raptors, and waterfowl use the highly productive aquatic and riparian habitats along Lower McDonald Creek. Many areas in and around the Lake McDonald developed area are also used by wildlife. There is a grizzly bear travel corridor immediately east of the developed area across Going-to-the-Sun Road. Going-to-the-Sun Road crosses the Continental Divide at Logan Pass (elevation 6,646 feet), and the alpine and subalpine habitats traversed by Going-to-the-Sun Road are important for grizzly bears, lynx, golden eagles, bighorn sheep, mountain goats and wolverines.

The St. Mary Valley, including the Rising Sun developed area, provides excellent forage and cover for a variety of wildlife species, including grizzly and black bears, mountain lions, lynx, wolverine, coyotes, gray wolves, bald and golden eagles, fisher, marten, and all six ungulate species found in the park. Bald and golden eagles, northern goshawks, harlequin ducks, Cooper's hawks and pileated woodpeckers all nest in the valley. The east side of the park provides excellent winter range for bighorn sheep and mountain goats because the strong winds and sparse vegetation leave the south facing slopes relatively free of snow in winter. Bighorn sheep and mountain goats winter in the St. Mary Valley in the vicinity of Rising Sun, often foraging above the Going-to-the-Sun Road. Important elk calving areas border the St. Mary Campground and the Rising Sun developed area.

Two Medicine

The Two Medicine area provides year-round habitat for grizzly bears and a wide range of other wildlife from elk, moose, and deer to forest predators such as wolverine, marten, black bears, northern goshawks, and lynx. Avalanche chutes, stream bottoms, wet meadows, and burns are very productive areas that provide essential spring and fall grizzly bear habitat.

The Two Medicine drainage also contains critical fall, winter, and spring habitat for bighorn sheep, mountain goats, and other ungulates. There is nesting habitat in the area for bald eagles, golden eagles, common loons, harlequin ducks, and other rare and sensitive bird species. Lynx have been frequently sighted in the valley and family groups have been observed on several occasions. Habitat diversity in the Two Medicine area is quite high due to the combination of grasslands, aspen parklands, conifer forest, riparian woodlands, subalpine shrublands, and alpine plant communities. Wolves have been observed in the area, but denning has not been documented. An important grizzly bear and bighorn sheep travel corridor is at the foot of Two Medicine Lake adjacent to the developed area and campground.

Many Glacier

The Many Glacier area is a crossroads for wildlife because it is located where three valleys meet and contains outstanding year-round habitat for numerous wildlife species, including grizzly bears, lynx, wolverine, bighorn sheep, mountain goats, elk, moose, white-tailed deer, mule deer,

and golden eagles. Gray wolves use the area during spring and fall and less frequently during summer and winter. Wolf denning has not been documented in the area. Numerous avalanche chutes and shrubfields provide important grizzly and black bear habitat in spring, summer, and fall. Highly productive riparian woodlands, sedge meadows, and other wetlands are habitats for countless species in the area, including bears, moose, deer, small mammals, songbirds, fisher, marten, mink, beaver, bats, amphibians, and raptors. The drainage contains critical winter and spring range for bighorn sheep as well as lambing and rutting grounds. Several bighorn sheep migration corridors that have probably been in continual use for over 4,000 years go across the drainage, providing connectivity between seasonally important habitats.

Large parts of the drainage are in the alpine zone and contain steep talus fields and cliff bands. The areas provide habitat for mountain goats and cliff-nesting raptors, such as golden eagles and prairie falcons. Isolated, forested mountain ridges provide secure habitat for large herds of elk throughout the spring, summer, and fall. Bald eagles frequent the lakes in the drainage, and one nest was found in 2003.

Several documented wildlife corridors cross the developed area at Many Glacier. Wolverine, grizzly bears, gray wolves and lynx, among other wildlife, use these corridors. A bighorn sheep route crosses directly behind the Many Glacier Hotel and is often used by bighorn sheep in the fall and spring to reach secure lambing and rutting areas. In addition to being an important wildlife movement corridor, the Many Glacier developed area has critical bighorn sheep winter range. The lack of human activity in the winter at Many Glacier encourages shy species like lynx, marten, fisher, and wolverine to use habitat in the developed area during that time. Very little is known about their specific habitat use and requirements in the area in summer. Grizzly bears are known to use the developed area for travel and foraging.

The Many Glacier Valley floor is narrow and contains several large lakes. There is north-south movement of many species of wildlife in the limited forested areas between the lakes, including the Swiftcurrent developed area. Grizzly bears, bighorn sheep, lynx, wolverine, elk and moose are known to use the wildlife corridors in and around the Swiftcurrent developed area. The open grassland slopes of Mt. Altyn are important fall, winter, and spring range for bighorn sheep and mountain goats. Sheep lambing also occurs in the area. Grizzly bears use all of the Many Glacier Valley during spring, summer and fall, including parts of the Swiftcurrent developed area. Numerous lynx and wolverine have been documented in and around the developed area year-round. Golden eagles nest on cliffs next to the developed area, and northern goshawks have been documented in the area.

Goat Haunt-Belly River
The Goat Haunt-Belly River area contains habitat for large populations of elk, moose, bighorn sheep, and deer. Mountain goats are common in the higher elevations, and raptors, including golden eagles and prairie falcons, regularly nest in cliffs throughout the area. Bald eagles also nest in old-growth vegetation next to lakes in both the Waterton and Belly River drainages. There is regular wolf activity in the area, but denning has not been confirmed. The area has habitat for grizzly and black bears, mountain lions, lynx, wolverine, fisher, and marten. Common loons and harlequin ducks have historically nested in the area.

North Fork
The North Fork area provides critical winter range for most ungulate species in the park except for bighorn sheep. The year-round presence of diverse ungulate populations in the valley makes the North Fork an ideal place for large and mid-sized carnivores, including gray wolves, grizzly bears, black bears, mountain lions, bobcats, coyotes, and lynx. The first documented denning of wolves in Glacier National Park in 50 years took place in the North Fork Valley in 1986 (Ream

et al. 1991). Most large lakes in the North Fork support nesting pairs of bald eagles, osprey, and common loons. Wide-ranging wildlife species such as grizzly bears, wolves, and elk, often leave the park and fulfill many of their needs on adjacent lands.

Middle Fork
Due to remote access, there is limited information about wildlife use in much of the Middle Fork area. Wildlife use of areas along U.S. Route 2 and the Middle Fork of the Flathead River is better understood. A prominent mineral lick along the Middle Fork of the Flathead near Walton draws mountain goats from a wide geographic area, especially in spring and early summer. The Belton Hills near West Glacier have important winter range for large numbers of deer and elk. Other winter ranges for elk and deer are on south-facing slopes in the Middle Fork. A pair of bald eagles has nested successfully near Nyack Creek, and forage along the corridor of the Middle Fork of the Flathead River where float trips occur. Lynx were historically present throughout the Middle Fork, but systematic surveys have only recently detected this uncommon carnivore in the area. However, surveys on the nearby Flathead National Forest have documented evidence of continued occupation by lynx. Grizzly bears, mountain lions, wolverine, and gray wolves also occupy the Middle Fork, indicating the presence of healthy ungulate populations in the area. Harlequin ducks breed in streams in the Middle Fork.

Bald Eagles
On June 28, 2007, the bald eagle (*Haliaeetus leucocephalus*) was officially removed from threatened status of the federal listing. Though protection under the Endangered Species Act no longer applies, the bald eagle is still protected under the *Bald and Golden Eagle Protection Act* and the *Migratory Bird Act*. Given these additional protection laws, the park opts to evaluate the bald eagle in a separate section of the wildlife assessment.

Bald eagles use portions of Glacier National Park on a year-round basis as nesting and wintering residents (Yates 1989), and as seasonal migrants (McClelland et al. 1994, Yates et al. 2001). There are 11 known bald eagle breeding areas in the park, including five in the North Fork Valley, two in the Goat Haunt-Belly River area, one in the Middle Fork Valley, one at Lake McDonald, one at St. Mary Lake, and one in the Two Medicine Valley. There is another nest within 5 kilometers of the western park boundary in the North Fork Valley, and it is likely that these eagles forage inside the park as well. Documented spring and summer eagle activity in the Many Glacier Valley indicates there might be other resident bald eagles nesting near Sherburne Reservoir (NPS files). Glacier National Park is within a major bald eagle migration corridor (McClelland et al. 1994, Yates et al. 2001). During winter, some eagles remain to forage on Lake McDonald and along the Middle and North Forks of the Flathead River. A primary bald eagle and golden eagle migration route crosses the upper end of Lake McDonald.

The *Montana Bald Eagle Management Plan* (Montana Bald Eagle Working Group 1994), an extension of the *Pacific States Bald Eagle Recovery Plan* (USFWS 1986), provides general guidance and *Glacier National Park's Bald Eagle Operational Plan and Habitat Management Guidelines* (NPS 1999b) provides site-specific information and outlines habitat management actions for the protection and perpetuation of bald eagle use areas in the park.

Nesting habitat characteristics of bald eagles include old-growth forest types near water, where eagles are afforded some seclusion from human activity. Many nest-sites are located near lake inlets and larger rivers, where foraging for fish is productive. Vegetative screening provides much of the necessary seclusion for eagles near nest, roost, forage, and feeding areas (Caton et al. 1992). Restrictions on human activity are implemented during the nesting season in the

Kintla Lake, Bowman Lake, Logging Lake, Lake McDonald, and St. Mary Lake bald eagle nest-site management zones (NPS 1999b).

Productivity of Glacier's nesting bald eagle population is lower than productivity documented for the rest of Montana (NPS files), and less than that recommended in the *Pacific States Bald Eagle Recovery Plan* (USFWS 1986) for maintaining viable populations of nesting bald eagles. Reasons for lower productivity in the park might include severe winter and spring weather, deterioration of native fisheries (prey species), and human disturbance near nest and forage sites.

Bald eagles are especially sensitive to human disturbance during the breeding period (Hamann et al. 1999). The breeding period includes courtship (late February to mid-April), egg laying and incubation (late March to late May), nestling stage (mid-May to early August), and fledging (early August to late September). Effects of disturbance on breeding birds during incubation could include short-term nest abandonment or nest desertion resulting in exposure of the eggs to detrimental temperature extremes and predators (Hamann et al. 1999). Disturbance during rearing can result in trampling of young, young jumping or falling from nests before they can fly, and/or separation of young from parents. Chronic disturbance can cause nest abandonment. The potential for nest failure and nestling death due to human disturbance is reduced, but not eliminated, after nestlings reach an age of about 4 weeks (usually early to late June in GNP). Nestlings usually fledge at 10 to 12 weeks of age (by mid-August), but young eagles do not migrate from breeding areas until sometime between mid-September and early October (McClelland et al. 1996). Outside of the breeding season, disturbance by humans might cause birds to alter their feeding habits, thereby reducing normal food intake (Hamann et al. 1999). Bald eagles frequently use snags for perching sites.

Impact Analysis - Wildlife

No Action Alternative

Removal of hazard trees can impact those wildlife species which use snags for habitation, foraging, or perching. Large snags are important to such wildlife as woodpeckers, bats, squirrels, bald eagles, and insects. Protocols are in place to examine trees for regular wildlife use and to consider alternative treatment actions for those trees found to be important for wildlife. However, some wildlife trees would require removal if the reduction of risk is given higher prioritization. Most hazard trees would be removed from developed areas which make up a very small percent of the park and are often avoided by wildlife species. Noise from chainsaws used to fell hazard trees might temporarily disturb some animals in the immediate vicinity. Under this alternative, there are no guidelines for planting young trees in areas where several hazard trees have been dropped. This could ultimately result in a lack of trees in some developed areas and preclude the use of these areas by some wildlife species. In the past four years, an average of 127 hazard trees was mitigated annually throughout the park. Without managed recruitment or planting of young trees this rate of cutting could have a long-term effect on wildlife populations in developed areas. The overall impact to wildlife populations in the park would be minor to moderate localized long-term adverse.

Hazard tree management actions could potentially impact bald eagles in the park through noise disturbance and a reduction in the availability of potential perches, especially foraging perches. Noise disturbance from hazard tree management actions is not expected to considerably impact bald eagles in the park. The action of removing or altering trees with a chainsaw is of short duration and would only temporarily disturb eagles foraging nearby. Bald eagles in Glacier

typically build nests away from the immediate vicinity of developed areas. Therefore, it is unlikely that nest trees would be removed due to their hazard potential or be affected by noise from chainsaws. Currently, there are chainsaw restrictions in place at a few lakes when eagle nests are occupied, but this is not a park-wide restriction.

Eagles would only be impacted if they use perches in or adjacent to developed areas since hazard trees are only removed from areas with potential targets (i.e., human-use areas). Some important foraging areas are also popular visitor service areas. For example, the Lake McDonald Lodge area has numerous targets for which trees might become hazards and the area is also frequently used by eagles for foraging. The continued removal of known and potential perch trees, especially along shorelines, could, over time, impact the ability of bald eagles to forage effectively.

Important characteristics for eagle foraging perches might include: proximity to potential prey, isolation from disturbance, good visibility of surrounding terrain, and accessibility for landing and departing (Stalmaster 1987). During the 1985-1988 nesting season, Caton et al. (1992) studied the use of foraging perches used by bald eagles at breeding territories at Lake McDonald, Logging Lake, and Waterton Lake and compared the results to the composition of trees available for use in these areas (i.e., random or expected values). The authors concluded that during the nesting season, when food demands are high, the availability of preferred perch types at favored foraging sites (e.g., inlets and shallows of lakes) might influence territory and nest-site selection as well as nesting success.

Shoreline foraging perches are likely to continue to present hazard tree management conflicts in the park because of their importance to eagles and due to the presence of several developed areas along lakes. However, a review of potential target locations within breeding eagle home ranges (2.5-mile radius centered on the nest) and of known foraging areas shows that foraging perches in most nesting territories have little potential for being affected by hazard tree management actions. Specifically, the impacts of hazard tree management on eagles at the following locations are not substantial:

- Kintla, Bowman, Logging, and Cosley lakes all have designated campgrounds in the backcountry zone near eagle nests. However, the backcountry campgrounds at these lakes are closed to shoreline access during the breeding season leaving only a short fall period during which the designated campgrounds might be used. The designated campgrounds are set back from the shoreline and no important perch trees are known from the campground vicinities. However, the designated campgrounds in the backcountry zone at all of these lakes are at the inlets of small creeks that could potentially be attractive as eagle foraging sites; lack of documentation of perch sites at these locations might reflect lack of use or a relative lack of effort to determine use. Since these designated campgrounds are at secondary streams and not at the major inlets and outlets where documented eagle use is greatest, loss of potential perch trees, if necessary, is expected to be less, and would probably have little impact. However, this conclusion is not based on research or intensive monitoring.
- Kintla Lake also has a developed auto campground (including campsites, day use area, ranger station, patrol cabin, boathouse and launch, and trailheads) at its outlet (opposite end of lake from nest) and a patrol cabin at its head. The patrol cabin is near the inlet, and within 300 m of the nest, but the known perch trees are probably not close enough to the cabin to be considered hazard trees. There are known perch trees at the auto campground at Kintla Lake outlet and near the two patrol cabins at the SW corner. There are probably additional perch trees at the lake outlet and along the lakeshore at

the edge of the campground. Eagles would most likely be affected by hazard tree removal along the lakeshore near the patrol cabins and boathouse, less so in the campground; trees at the outlet might be too far from campground or parking sites to pose a hazard.

- Bowman Lake also has a developed auto campground at its outlet. At this campground, known perch trees are located near the smaller patrol cabin on the SW corner; eagles might also use perch trees at the outlet, near the boat launch site, or at the patrol cabin on the bluff at the NW end. There are no developments as potential targets near the outlet or the boat launch site, since parking is prohibited, but existing or potential perch trees could be removed as hazard trees near the two cabin sites.
- Logging Lake has patrol cabins at both ends of the lake. There might be a few existing or potential perch trees within striking distance of the cabins, especially the upper cabin where there are known perch trees along the lakeshore in front of the cabin.
- At Cosley Lake the only developed area within a 2.5-mile radius of the nest is a backcountry campground as described above.
- At Quartz Lake, most recent nesting activity has occurred at the head of the lake where there are no targets. A previous nest location (used in the 1960s and 1970s) at the foot of the lake included a foraging area at the lake outlet which is 200 meters from a patrol cabin and 350 meters from the designated campground in the backcountry zone. The outlet area continues to be used for foraging, and though there has been little recent effort to document use, there might be undocumented existing or potential perch trees in the vicinity of the cabin or campground. The primary foraging site at the outlet end of the lake is probably at the outlet itself, with less use of perch trees near the cabin or campground.
- The eagles which use the Nyack breeding territory forage primarily along the Middle Fork of the Flathead River where hazard tree management actions would not be implemented due to a lack of potential targets.
- There are no targets near the shore of Lower Two Medicine Lake that would require the removal of potential foraging perches. There are several potential targets on nearby Two Medicine Lake, which is occasionally used for foraging; however there are no known perches in the immediate vicinity of these targets.
- At Lake Sherburne, there are no potential targets at which hazard tree actions would be required. Bald eagles are sometimes seen on other lakes in the Many Glacier Valley, but no efforts have been made to document perch sites used by the nesting birds. Based on the available anecdotal information, it appears the pair nesting on Lake Sherburne would be largely unaffected by future hazard tree removal.
- Waterton Lake has several structures along its shore that could become hazard tree targets. However, no perch trees are known near the structures, possibly because of the amount of human presence in the summer. Bald eagles are known to perch near the boathouse, dock area, and the Waterton River inlet in the Goat Haunt area, but it is unknown if perch trees are near enough to these facilities to be considered hazard trees.
- Most potential targets at St. Mary Lake do not sit on the lakeshore. The only potential shoreline hazard tree targets are the picnic and boat dock areas. No perch locations are

known from this location and a wildlife biologist would be consulted prior to removal of trees at this site.

Impacts to nesting or migrant bald eagles from hazard tree management appear to be minimal at the preceding locations because there are relatively few potential hazard tree targets, and potential replacement perch trees appear to be abundant. However, this assessment is based on limited information on eagle use, and very limited analysis of impacts associated with previous hazard tree removals. A wildlife biologist is consulted prior to cutting any wildlife tree.

Activities planned under the Hazard Tree Management Program would most likely have the greatest effect on bald eagles using the Lake McDonald area, especially considering past tree removal actions in this area. Several screening trees and two perch trees were removed in this area during 1987 and 1988 because of their imminent risk of falling. Several conservation measures are currently in place to mitigate the impacts of human activities on eagles at the north end of Lake McDonald, including seasonal restrictions on boating, fishing, and shoreline access.

We summarized the records of hazard trees removed from areas surrounding Lake McDonald between 1994, when the most recent *Hazard Tree Management Plan* was implemented, and 2004. The mean dbh (9.7 in.) and mean height (50.9 ft.) of hazard trees was considerably less than that of eagle perches observed by Caton et al.(1996) (mean dbh = 26.4 in. and mean height = 78.1 ft.) in the park. Only 14% (184) of hazard trees were taller than 70 feet. Considering only those trees removed from the north end of the lake (i.e., Sprague Creek Campground, Lake McDonald Lodge, North/NW Shore), where foraging is often concentrated, then the percentage of hazard trees taller than 70 ft. increases to 37%.

Considering the relatively small size of most of the hazard trees removed in the past ten years, and the availability of potential replacement perch trees (particularly as a result of the 2003 Roberts Fire), hazard tree management actions around Lake McDonald have probably not substantially impacted the availability of eagle perch trees. However, some of the smaller trees might have served as screening for perch trees and their removal might have resulted in increased disturbance to foraging eagles. In addition, some individual trees are obviously relatively more important to foraging eagles, especially at the north end of Lake McDonald. In the past, hazard tree managers have taken considerable care in identifying important wildlife trees and consulting with park biologists, though the ultimate outcome has often been the removal of identified hazard trees. This would continue to occur under the No Action Alternative and no new young trees would be planted to replace the removed trees.

The No Action Alternative would have a moderate local long-term adverse impact on threatened and endangered species in the park, primarily on bald eagles.

Cumulative Effects. Other projects that result in tree removal in the park such as fuel reduction and removal of trees for new structures are minor and localized in scope. However, many of these activities would occur in the same areas as hazard tree program actions, primarily developed areas. This could exacerbate the impacts to bald eagles that frequently forage near developed areas in the park. Therefore, cumulative impacts of hazard tree management and other projects within the park would be moderate local long-term adverse to wildlife including bald eagles. Actions such as logging that might occur on adjacent lands would be conducted at a larger scale than hazard tree management and focus on live trees. The cumulative effects with projects outside of the park, and regionally, would be negligible.

Preferred Alternative

Impacts to wildlife under this alternative would be similar to those under the No Action Alternative. Some wildlife trees would still require removal if in imminent danger of falling on a target. However, this alternative provides guidance for planting young trees in areas where hazard tree removal has resulted in substantial loss of the overstory. These trees would require many years of growth before providing wildlife habitat similar to a mature tree, but replacement would eventually occur. Some new measures would be implemented to lessen impacts to bald eagles. The following new conservation measures would be implemented under this alternative:

- A Wildlife Biologist would train crews in how to identify a potential "wildlife tree" at the beginning of each season.
- Any hazard trees identified as "wildlife trees" and requiring removal would not be cut until the fall to avoid potential impacts on breeding species that might be using the tree.
- The park would begin collecting additional information during hazard tree examinations. For trees within 300 feet of a lakeshore, the distance to the shore would be recorded as would the tree's status as a bald eagle perch tree (after consultation with a Wildlife Biologist).
- Chainsaws would not be used within a ½ mile of a bald eagle nest prior to July 15.
- The park proposes to plant two young trees, of the same species and in the same general vicinity, for all trees removed for hazard tree purposes wherever possible. The trees would be grown from seeds collected in the park and raised in the park's native plant nursery. Records would be kept on the species, tree age, and location of all newly planted trees and monitoring would be performed to determine their survival rate.
- Periodically, hazard tree data, including planting records, would be reviewed to re-assess the potential cumulative impacts of the program on perch trees and lakeshore tree recruitment.
- The park plant ecologist would provide a map of rare plant locations to the hazard tree program manager prior to the start of cutting activities each year.
- Consider conducting additional research or monitoring, if funding is available, on perch trees along Lake McDonald and the effects of hazard tree removal.

The noise could temporarily displace or scare a bald eagle off a nest. If there are nesting bald eagles in the immediate vicinity of a tree that requires removal, the action would be postponed, if possible. Only the Lake McDonald nest has potential targets within ½ mile of the nest. At this location several cabins and outbuildings fall just inside the ½ mile radius. Other impacts to bald eagles would be the same as described in the No Action alternative.

In places where many older trees have been removed or topped a new emphasis would be placed upon recruitment of young trees. The park proposes to plant two young trees, of the same species and in the same general vicinity, for all trees removed for hazard tree purposes. However, in some areas where disease is the primary cause of tree mortality, new trees might become just as susceptible to becoming hazard trees. Therefore, consideration must be given to the species to be planted, and replacing removed trees with the same species might not always be appropriate. The trees would be grown from seeds collected in the park and raised in the park's native plant nursery. Records would be kept on the species, tree age, and location of all newly planted trees and monitoring would be performed to determine their survival rate.

Periodically, hazard tree data, including planting records, would be reviewed to re-assess the potential cumulative impacts of the program on perch trees and lakeshore tree recruitment.

The overall impact to wildlife populations in the park including bald eagles would be **minor localized long-term adverse**.

Cumulative Effects. Other projects that result in tree removal in the park such as fuel reduction and removal of trees for new structures are minor and localized in scope. However, many of these activities would occur in the same areas as hazard tree program actions, primarily developed areas. Planting new trees after removing hazard trees would reduce the overall loss of trees, and cumulative impacts of hazard tree management and other projects within the park would be minor local long-term adverse. Actions such as logging that may occur on adjacent lands would be conducted at a larger scale than hazard tree management and focus on live trees. The cumulative effects with projects outside of the park, and regionally, would be negligible.

Conclusion for Both Alternatives.

The No Action Alternative would result in localized moderate long-term adverse impacts due to unmitigated removal of hazard trees, without replacement by younger trees, especially in developed areas. Cumulative effects under the No Action Alternative would be local minor long-term adverse to developed areas. The Preferred Alternative institutes some new conservation measures, including planting young trees to replace hazard trees, that would reduce the impacts to minor local long-term adverse. Cumulative impacts would also be local minor long-term adverse to developed areas.

Because there would be no major, adverse impacts to wildlife resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation and proclamation of Glacier National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's *General Management Plan* or other relevant National Park Service planning documents, there would be no impairment of the park's resources or values.

Threatened Species

The US Fish and Wildlife Service (FWS) have identified three threatened species that may be present in the vicinity of Glacier National Park. The following table lists these species.

Table 7: Threatened, Endangered & Candidate Species that are present in GNP

COMMON NAME	SCIENTIFIC NAME	STATUS	RANGE – MONTANA
Gray Wolf	*Canis lupus*	Endangered (as of July 28, 2008; pending litigation)	Resident, transient; Forests in western Montana
Bull trout	*Salvelinus confluentus*	Threatened; Critical Habitat	Clark Fork, Flathead, Kootenai, St Mary, and Belly river basins; cold water rivers and lakes.
Grizzly Bear	*Ursus arctos horribilis*	Threatened	Resident, transient; Alpine/subalpine coniferous forest
Canada Lynx	*Lynx canadensis*	Threatened; Critical Habitat	Resident; western Montana – montane spruce/fir forests

(http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/National_Parks/Glacier_sp_list.pdf).

While present in Flathead County, there are no known locations of the threatened Spalding's catchfly (*Silene spaldingii*) or water howellia (*Howellia aquatilis*) within GNP; consequently, there would be no effect to Spalding's catchfly, water howellia from the proposed project. However, if locations of listed plant species become known, within the vicinity of hazard tree mitigation activities, the plants would be avoided. The proposed actions would have no effect on bull trout, as there are no expected impacts to water resources within the park. The proposed action would not alter habitats or human-use patterns in or near areas that could potentially serve as den sites, therefore they would have no effect on Canada lynx, as they would not have any measureable or perceptible consequence to an individual, its population or critical habitat. Gray wolves are not expected to be impacted from actions proposed in the hazard tree plan.

Grizzly Bear (Threatened)

Glacier National Park is part of the Northern Continental Divide Ecosystem (NCDE) recovery area for the threatened grizzly bear. Population estimates for this ecosystem vary between 549-813 bears (USFWS 1993). The NCDE is especially important for grizzly bear population because it adjoins occupied grizzly bear habitat in Canada. Fieldwork conducted during 1998-2000 identified 246 grizzly bears in GNP, however, many of these bears were also found in the areas surrounding the park (Stetz 2003). These preliminary results are from a recent study using non-invasively collected hair samples and DNA finger printing (Kendall and Waits 2002). Exact population estimates and trends are difficult to establish due to the lack of intensive population level research within this ecosystem and the inherent problems of counting the widely distributed and reclusive grizzly bear. The *Grizzly Bear Recovery Plan* (USFWS 1993) and the *Glacier National Park Bear Management Plan* (NPS 2001) serve as guidelines for management of grizzly bears in GNP. The plans outline actions that are required to protect and recover the federally listed grizzly bear.

Grizzly bear habitat is found throughout the park and ranges from the lowest valley bottoms to the summits of the highest peaks. Grizzly bears require large areas of undeveloped habitat (including a mixture of forests, moist meadows, grasslands, and riparian habitats) and a substantial amount of solitude from human interactions (USFWS 1993). Grizzly bear seasonal movements and habitat use are tied to the availability of different food sources.

In spring, grizzly bears feed on dead ungulates and early-growing, herbaceous vegetation at lower elevations (Martinka 1972). Avalanche chutes provide an important source of herbaceous forage for grizzly bears in the early summer and fall (Rockwell 1995). During the summer, some bears move to higher elevations in search of glacier lilies and other roots, berries, and army cutworm moths (*Euxoa auxiliaris*). During the huckleberry (*Vaccinium* sp.) season (late summer and fall); bears often concentrate in the Apgar Mountains, Belton Hills, Snyder Ridge, Many Glacier Valley, Two Medicine Valley, and other areas. Grizzly bears in Glacier National Park use alpine meadows from late spring through late fall for foraging (Martinka 1972). In addition to diverse foraging habitat, grizzly bears require natural habitat that provides connectivity, or travel corridors, between foraging sites.

During the winter, grizzly bears hibernate in dens away from human disturbance, typically at higher elevations on steep slopes where wind and topography cause an accumulation of deep snow. The denning season in the western portion of the NCDE usually begins in early October, and females might linger near dens until late May.

Grizzly bear/human interaction is a management concern that can enhance the risks of visitors as well as that of bears. Bears that are familiar with humans have the potential to become habituated to human presence, leading to further habituation and increased potential for bear/human encounters. Habituated bears are usually relocated or hazed from developed areas, and food-conditioned bears are oftentimes removed from the population. Bears not habituated to humans are likely displaced from foraging areas and travel routes in proximity to developed areas where most hazard tree management actions would occur. In the backcountry zone, bears probably also avoid human-use areas such as designated campgrounds.

Glacier National Park was placed into grizzly bear management "situations" in accordance with the *Grizzly Bear Recovery Plan* (USFWS 1993). Almost 1 million acres (recommended wilderness) is established as Management Situation 1, in which management decisions would favor the needs of the grizzly bear when grizzly habitat and other land-use values compete, and grizzly-human conflicts would be resolved in favor of grizzlies, unless a bear is determined to be a nuisance. Maintenance and improvement of grizzly bear habitat and grizzly-human conflict minimization would receive the highest management priority in these areas. The remainder of the park, which is developed front-country, is established as Management Situation 3, in which grizzly habitat maintenance and improvement are not the highest management considerations, grizzly bear presence would be actively discouraged, and any grizzly involved in a grizzly-human conflict would be controlled. With the exception of in designated campgrounds and around historic structures in the backcountry zone, hazard tree management activities would occur in Management Situation 3.

Impact Analysis – Threatened and Endangered Species

No Action Alternative

Actions under this alternative would continue **minor, adverse, short (temporary) and long-term and localized** impacts on grizzly bears. The noise could continue to temporarily displace grizzly bears from an area. Grizzly bears are most likely to be present in an area during the early spring or late fall when there are few visitors in the park. Due to the infrequent nature of hazard tree treatment actions during these times as well, incidental disturbance of the grizzly bear would be rare and infrequent but might occur. Actions under this alternative might continue to disturb food sources temporarily but would not have an impact on prey population numbers or frequency. Habitat for these species would not be substantially impacted.

Cumulative Effects. Actions proposed in this alternative, combined with other projects that result in tree removal in the park (such as fuel reduction and removal of trees for new structures), are minor and localized in scope. However, many of these activities would occur in the same areas as hazard tree program actions, primarily developed areas. Planting new trees after removing hazard trees would reduce the overall loss of trees, and cumulative impacts of hazard tree management and other projects within the park would be **minor, localized, long-term, and adverse**. Actions such as logging that might occur on adjacent lands outside of the park would be conducted at a larger scale than hazard tree management. This could cause dispersal of grizzly bears on National Forest land into the park, increasing populations and competition for resources. The cumulative effects with projects outside of the park, and regionally, would be minor.

Preferred Alternative

Impacts of the Preferred Alternative would be similar to those described for the No Action Alternative. Overall, the Preferred Alternative would result in **minor, localized, short (temporary) and long-term, and adverse** impacts to grizzly bears.

Cumulative Effects. Actions proposed in the Preferred Alternative combined with other projects that result in tree removal in the park (such as fuel reduction and removal of trees for new structures) would be identical as listed for the No Action Alternative: **minor and localized**.

Conclusion for Both Alternatives.

Impacts from the Preferred Alternative would be minor, adverse, short (temporary) and long-term and localized for the grizzly bear. Cumulative impacts in conjunction with the Preferred Alternative would be minor, localized, short (temporary), long-term and adverse as a result of incidental disturbance and possible temporary displacement. Under Section 7 of the Endangered Species Act, park biologists have determined that this project might affect but is not likely to adversely affect the grizzly bear. A Biological Assessment (BA) has been prepared and submitted to the US Fish and Wildlife Service.

Because there would be no major, adverse impacts to grizzly bear resources whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation and proclamation of Glacier National Park; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's resources or values.

Ethnographic Resources

Ethnographic resources are sites, structures, objects, landscapes, or natural resource features assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it (NPS Director's Order 28). The Blackfeet, Kootenai, and Salish Indian Tribes, have a long-standing association with the Glacier National Park area. They have frequented the region hunting and camping; gathering plants and other resources; and carrying out religious ceremonies.

Certain plants growing in the park are used as food, for materials, and in spiritual ceremonies and healing. The places where they grow are sometimes considered sacred, as are areas where ceremonies were once performed. A study of Blackfeet ethnobotany found a rich and thriving botanical heritage, with over 80 plants traditionally utilized by tribal members that grow within the boundaries of the park (NPS 2003). One such plant utilized by the Kootenai is the ponderosa pine from which the sweet cambium layer was traditionally harvested during the spring. This inner layer was exposed by cutting and prying the bark off in long strips along the trunk. This procedure does not kill the tree but leaves an elongated roughly triangular scar. Today, these trees are considered culturally scarred trees (CSTs) and are recognized as indicators of the tribe's presence on the landscape. CSTs have been identified in the North Fork area of the park. In 2006, the Montana SHPO concurred with the park in the National Register eligibility of 34 culturally scarred tree sites containing 74 individual trees.

Impact Analysis – Ethnographic Resources

No Action Alternative

Culturally scarred trees (CSTs) are the only ethnographic resource potentially impacted by hazard tree management activities. The CSTs identified to date are located outside of developed

areas and only one is located in the vicinity of a road (CSKTHPD 2004-2005). Therefore, there is little potential for identifying a CST as a hazard tree. However, if a CST was identified as a hazard tree the park would consult with the Confederated Salish and Kootenai Tribe (CSKT) and the State Historic Preservation Office. During consultation for this plan, the CSKT recommended that a CST identified as a hazard tree be topped above the scar. In addition, all hazard tree personnel would receive training in how to identify CSTs. At worst, the impacts to ethnographic resources would be **minor long-term local adverse** if a CST had to be topped. Under Section 106 of the National Historic Preservation Act of 1966 (as amended), the finding of effect would not be adverse.

Cumulative Effects. Since there is little possibility of a CST being impacted by hazard tree management no cumulative impacts with other projects are expected. Identified CSTs in the park are managed as cultural resources and are only threatened by wildfire. Any project within the park that could result in removal of a CST would be surveyed for cultural resources before trees were felled.

Preferred Alternative

Impacts on ethnographic resources under this alternative would be identical as those in the No Action Alternative: **minor long-term local adverse**.

Cumulative Effects. No cumulative effects are expected under either alternative.

Conclusion for Both Alternatives.

Culturally scarred trees are not expected to be impacted by Hazard Tree management activities. If a CST became a hazard tree and required treatment, it would be topped above the scar resulting in minor long-term local adverse effects to the resource.

Because there would be no major, adverse impacts to ethnographic resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation and proclamation of Glacier National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's *General Management Plan* or other relevant National Park Service planning documents, there would be no impairment of the park's resources or values.

Section 106 Summary. There is little potential for a culturally scarred tree to be identified as a hazard tree. However, if that should happen, Glacier National Park would complete formal Section 106 compliance with the Montana State Historic Preservation Office and the Confederated Salish and Kootenai Tribes. Topping the tree above the scar would likely result in a finding of no adverse effect.

Public Health and Safety

The primary impetus for developing a Hazard Tree Management Program is to reduce risks to visitors, employees and structures as directed in the Visitor Safety section of the *NPS Management Policies* (NPS 2006a). Weather in northwest Montana can often present extremes in rainfall, snowfall, and wind which can cause trees to fall and slowly weaken trees over time. Fire is also a natural and common cause of weakening trees. Trees along edges of openings such as lakeshores or parking lots are often the most exposed to the elements and trees in developed areas are also susceptible to soil compaction around their root systems. Since these are the same locations with high concentrations of visitors and staff, vigilance for hazard tree management is essential to reducing the risks to the public while visiting Glacier National Park.

Impact Analysis – Public Health and Safety

No Action Alternative

The No Action Alternative does not provide guidelines for regular surveys and treatment at designated campgrounds and around historic structures in the backcountry zone. Currently, backcountry rangers and trail crew personnel would remove fallen or leaning trees if they observe such a tree, but no systematic, proactive surveys are conducted. Visitors to the backcountry zone accept a higher level of personal risk but regular surveys might reduce that risk. The No Action Alternative would result in **moderate local long-term beneficial** impacts to reduction of risk in the visitor service and rustic zone and **moderate local long-term adverse** conditions would remain in the backcountry and day use zone.

Cumulative Effects. The park strives to reduce risk to the public but recognizes the limitation of not being able to eliminate all hazards. Some recent projects that have reduced risks for visitors and staff include a new parking lot for horse trailers at Walton, a new hay storage facility near Apgar to reduce employee injuries and risk of Hantavirus, and installation of new radio towers to improve communication to remote parts of the park. Hazard tree management would be influenced by these other projects because hazard tress might result from these improvements. Overall, the impacts to public health and safety would be **minor local long-term beneficial**.

Preferred Alternative

The Preferred Alternative would have similar impacts to this resource topic in the visitor service and rustic zones as the No Action Alternative: **moderate local long-term beneficial**. In the backcountry and day use zones, impacts would also be moderate local long-term beneficial because of regular, proactive surveys and treatment for hazard trees at developed areas in the backcountry zone.

Cumulative Effects. The cumulative effects for the Preferred Alternative would be the same as those for the No Action Alternative: **minor local long-term beneficial**.

Conclusion for Both Alternatives.

The No Action Alternative would result in different levels of impact for the visitor service zone (moderate local long-term beneficial) and the backcountry zone (moderate local long-term adverse). All zones of the park would have moderate local long-term beneficial impacts from the Preferred Alternative. Cumulative effects would be the same for both alternatives: minor local long-term beneficial.

Recommended Wilderness

Glacier National Park completed a study and environmental impact statement in 1973 to comply with the 1964 Wilderness Act. That document was reviewed by the public and recommended that over 90% of the park should be formally designated as wilderness. President Nixon forwarded that recommendation to Congress on June 13, 1974. A bill was subsequently introduced to designate the land as wilderness. That bill was never enacted, but since that time, the lands have been defined as recommended wilderness and managed as designated wilderness by the NPS in accordance with NPS Policy. NPS policy requires management of proposed or recommended wilderness as designated wilderness until the land is either formally designated or rejected by Congress. Until, that time all the area identified as recommended wilderness will continue to be managed as wilderness. Amendments to the wilderness recommendation of 1974 were made in 1984 and 1994 that made minor adjustments to the original proposal and

increased the amount of proposed wilderness to 95% of the park's total area (NPS1999a). Wilderness in Glacier National Park is defined as lands that are essentially undeveloped or are natural in character and lie at least 250 feet from established roadways and development zones.

The backcountry zone is managed to retain the distinctive characteristics of the recommended wilderness area by delineating a set of desired resource conditions, visitor experiences, types of management activities and development (NPS 2006b). Primitive facilities such as trails, designated campsites, and historic structures are maintained while the natural resources in this zone remain in their pristine state. Management of natural resources is limited to necessary restoration activities and protection. Cultural resources are preserved and protected in accordance with the law and NPS policy.

All six of the geographic areas in Glacier National Park (North Fork, Goat Haunt-Belly River, Many Glacier, Going-to-the-Sun, Middle Fork, and Two Medicine) include a backcountry management zone which encompasses the remaining area not included in the visitor service or day use zones. It is managed to maintain natural processes. Visitor uses include hiking, horseback riding, and backcountry camping. "Leave no trace" skills and ethics are encouraged. Developments include trails, designated campsites, primitive signs, sanitation facilities and patrol cabins.

Certain identified historic structures are maintained and protected within recommended wilderness.

Impact Analysis – Recommended Wilderness

No Action Alternative

This alternative would have continued **negligible to minor, adverse, short (temporary) and long-term and localized** impacts on recommended wilderness due to hazard tree removal. Removal of a hazard tree would open the canopy and increase sunlight to the forest floor benefiting lower plant and sapling growth. This would happen whether or not the hazard tree was removed as an action of this alternative or by nature. Remaining stumps would be detectable, though slight, and would remain causing long-term impacts in the area around designated campsites and historic structures.

Cumulative Effects. Protection of wilderness quality and value supersedes removal of hazard trees because this alternative does not specifically address hazard tree management in the backcountry zone which includes recommended wilderness. Cumulative effects would be negligible to minor, long-term and beneficial due to the park's commitment to ensure the quality and values of the wilderness would be preserved. If a major cumulative impact to the wilderness would result from the actions in this alternative the target would be moved if possible instead of the hazard trees.

Preferred Alternative

Completion of a *Minimum Requirement/Minimum Tool* analysis would ensure that the proper tool for hazard tree removal would have the least amount of impact to the wilderness character and values. This alternative would have similar impacts as stated in the No Action Alternative. **Negligible to minor, adverse, short- and long-term and localized** impacts to the quality and value of the recommended wilderness would result from removal of a hazard tree. Short-term, temporary impacts would be a slight audible noise in cases when the minimum tool analysis recommended chainsaw use in the backcountry zone.

Cumulative Effects. The preferred alternative would have the same cumulative impacts as

identified in the no action alternative. Impacts would be negligible to minor, long-term beneficial and localized.

Conclusion for Both Alternatives

The No Action and Preferred Alternatives would result in a similar level of impact for the backcountry zone which incorporates the park's recommended wilderness. Recommended wilderness is not located in the other management zones and therefore visitor service and day use zones were not included in the impact analysis for either alternative. Impacts would be **negligible to minor, adverse, short (temporary) and long-term and localized** for both alternatives.

Because there would be no major, adverse impacts to a recommended wilderness resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation and proclamation of Glacier National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's *General Management Plan* or other relevant National Park Service planning documents, there would be no impairment of the park's resources or values.

Summary of Compliance with Federal and State Regulations

National Environmental Policy Act (NEPA) and Regulations of the Council on Environmental Quality – The National Environmental Policy Act applies to major federal actions that may significantly affect the quality of the human environment. If the environmental effects are greater than negligible and or cannot be categorically excluded, then an Environmental Assessment is prepared to evaluate potential impacts. This Environmental Assessment meets the requirements of the NEPA and regulations on the Council on Environmental Quality in evaluating potential effects associated with implementing a hazard tree program and associated treatments on federal lands. If no significant impacts are identified and after the public review and comment period, a finding of no significant impact (FONSI) would be prepared. If significant impacts are identified, then a notice of intent (NOI) would be filed for preparation of an Environmental Impact Statement.

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) – Section 7 of the Endangered Species Act is designed to ensure that any action authorized, funded, or carried out by a federal agency likely would not jeopardize the continued existence of any endangered or threatened plant or animal species. If a federal action may affect threatened or endangered species, then a biological assessment must be prepared and submitted to the U.S. Fish and Wildlife Service (USFWS). Glacier National Park biologists have determined that this project would result in no effect on the bull trout, or federally listed plant species. Informal consultations would be sought with the USFWS for the grizzly bears as actions associated with the alternatives "may affect, not likely to adversely affect" these species on an incidental, short-term basis. A biological assessment will be submitted along with the environmental assessment for their review and concurrence.

Clean Water Act (CWA) and State and Local Water Quality and Floodplain Regulations— No permits are required and no development would occur within a floodplain.

Executive Order 11990, Protection of Wetlands-No wetlands would be affected by the No Action Alternative or Preferred Alternative according to the USFWS 1992) National Wetland Inventory Mapping. A statement of findings for wetlands will not be prepared.

National Historic Preservation Act of 1996, as amended (16 U.S.C. 470, et Seq.) – Section 106 of the National Historic Preservation Act of 1966 (as amended) requires federal agencies to consider effects of any federal action on cultural resources eligible for or listed in the National Register of Historic Places (NHRP), prior to initiating such actions. Culturally scarred trees are the only cultural resource potentially impacted by hazard tree management activities. There is little potential for a culturally scarred tree to be identified as a hazard tree. However, if that should happen additional compliance would be completed in accordance with Section 106 of the NHPA.

The Wilderness Act - Minimum Requirement Decision Process – Chapter 6 of the NPS Guidelines states "All management decisions affecting wilderness will further apply the concept of "minimum requirement" for the administration of the area regardless of wilderness category. The only exception is for areas that have been found eligible, but for which, after completion of a wilderness study, the Service has not proposed wilderness designation. However, those lands will still be managed to preserve their eligibility for designation."

The Wild and Scenic Rivers Act (16 USC 1271-1287) – The NPS has fulfilled its responsibilities to analyze proposals within the Wild and Scenic River corridor under Part 7 of the Wild and Scenic Rivers Act. Impacts to the river corridor would be negligible due to limited backcountry sites in the corridor that might have hazard trees. Removal of hazard trees would likely occur naturally during flooding events and removal operations would have negligible impacts on the corridor. This EA will be sent to the Flathead National Forest for their review and concurrence in accordance with the Memorandum of Agreement between the Flathead National Forest and Glacier National Park.

CONSULTATION/COORDINATION

AGENCIES/ TRIBES/ ORGANIZATIONS/ INDIVIDUALS CONTACTED (EA RECIPIENTS)

Federal and International

Advisory Council on Historic Preservation
Max Baucus, United States Senate
Jon Tester, United States Senate
Dennis Rehberg, United States House of Representatives
Flathead National Forest (Kalispell, Hungry Horse)
Premier of the Province of Alberta, Honorable Ed Stelmach
Waterton Lakes National Park
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service (Helena and Creston)
U.S. Forest Service entomologists (Missoula and Coeur d'Alene)
U.S. Geological Survey, Biological Resources Division
U.S. Department of the Interior, Office of the Solicitor

Tribes

Chair, Blackfeet Tribal Business Council w/copies to Tribal Council and the Blackfeet Tribal Historic Preservation Officer
Chair, Confederated Salish and Kootenai Tribes of the Flathead Reservation w/copies to Tribal Council and Confederated Salish and Kootenai Tribal Preservation Department

State

Brian Schweitzer, Governor of Montana
Environmental Quality Council, Director, Helena
Montana Department of Environmental Quality, Board of Environmental Review
Montana Department of Environmental Quality, Permitting & Compliance, Helena
Montana Department of Environmental Quality, Water Protection Bureau
Montana Department of Environmental Quality, Air Quality Division
Montana Department of Natural Resources and Conservation
Montana Fish, Wildlife, and Parks, Region One Supervisor, Kalispell
Montana State Historic Preservation Office
Stillwater State Forest

County and City

Flathead County Board of Commissioners
Glacier County Commissioners
Mayors and City Councils of Browning, Kalispell, Columbia Falls, and Whitefish, Montana
Public Libraries: Bigfork, Browning, Columbia Falls, Kalispell, Whitefish

Private

Backcountry Horsemen of the Flathead
Flathead Basin Commission
Friends of the Wild Swan
Glacier National Park Fund
Glacier Natural History Association
Glacier Park Inc.
Glacier Raft Company
Great Northern Whitewater Resort
Montana Preservation Alliance
Montana Raft Company
Montana Wilderness Association
National Parks Conservation Association
Wilderness Watch
Wild River Adventures

Individuals

If you would like to see a list of individuals on the park mailing list, please contact the park.

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