

STATE OF THE STEPHEN MATHER WILDERNESS 1994



North Cascades National Park
Ross Lake National Recreation Area
Lake Chelan National Recreation Area





STATE OF THE WILDERNESS

1994

STEPHEN MATHER WILDERNESS

North Cascades National Park Service Complex

Chelan, Skagit and Whatcom Counties, Washington State

PREFACE

In 1988, Congress designated 634,614 acres within North Cascades National Park Service Complex as the Stephen Mather Wilderness. In so doing, it directed the NPS to manage the area to protect and perpetuate its wilderness resources and to provide a special wilderness experience "involving outstanding opportunities for solitude or a primitive and unconfined type of recreation." In order to fulfill that mandate, North Cascades:

- Changed district boundaries so that the entire wilderness is managed as a unit.
- Developed a Wilderness Management Plan based on the Limits of Acceptable Change model.
- Appointed a wilderness committee made up of representatives from all divisions to coordinate wilderness related activities, review flight requests and other minimum tool concerns, and to advise the Superintendent about wilderness issues.

The purpose of this *State of the Wilderness Report* is to review the current status of the resources, human activity, and issues affecting the Stephen Mather Wilderness. This information will then be used to help evaluate the effectiveness of our present management strategies and to help determine if other management tools and techniques are available that would better meet wilderness objectives. This report follows the basic outline of the National Park Service *Annual Report to Congress on Wilderness Management*, adding sections where appropriate.

FOREWORD

This year marks the 30th anniversary of the Wilderness Act and the 5th anniversary of the Stephen Mather Wilderness.

Wilderness, as defined by the Wilderness Act, has three equally important characteristics:

It is a place not controlled by humans, where natural ecological processes operate freely and where its primeval character and influences are retained.

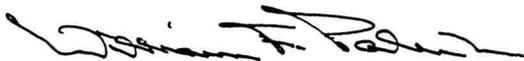
It is a place not occupied or modified by mankind, where humans are visitors, and the imprint of their activity is hardly noticeable.

It is a place with outstanding opportunities for the solitude necessary for a primitive and unconfined recreation experience.

Anyone who has spent time in the North Cascades appreciates the great extent to which these attributes are available in the Stephen Mather Wilderness. However, appreciating the values of wilderness and understanding the legislation designating specific wilderness areas for protection does not assure their preservation. For us and for succeeding generations of Americans devoted to safeguarding these cherished wild lands, their preservation is and will be a continuing challenge.

The staff of the North Cascades National Park Service Complex is understandably proud of the work done thus far to preserve the Stephen Mather Wilderness. This *State of the Wilderness Report* describes what we have done to increase our knowledge and understanding and to share that information with others, to address the impacts of historic practices, to identify external threats to resource integrity, to evaluate and apply management techniques consistent with the intent of the Wilderness Act, to accommodate recreational users and, perhaps most importantly, to prepare for the future.

The Wilderness Management Plan for the Stephen Mather Wilderness is an important tool for guiding our future efforts to preserve the wilderness. As we prepare to revise this plan, we look forward to the public involvement and exchange of ideas which will ensure the best possible product. We intend for this *State of the Wilderness Report* to promote this dialogue by providing all interested parties with a common base of information about this gem of the North Cascades.



William F. Paleck
Superintendent

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Section 1: Boundaries



North Cascades National Park Service Complex, composed of North Cascades National Park, Ross Lake National Recreation Area and Lake Chelan National Recreation Area, is located in the North Cascades Range in northwestern Washington. The Washington Wilderness Park Act of 1988 designated 93% of the total area of the North Cascades Park Service Complex as the Stephen Mather Wilderness.

Table 1-1: Wilderness Acreage of the Stephen Mather Wilderness

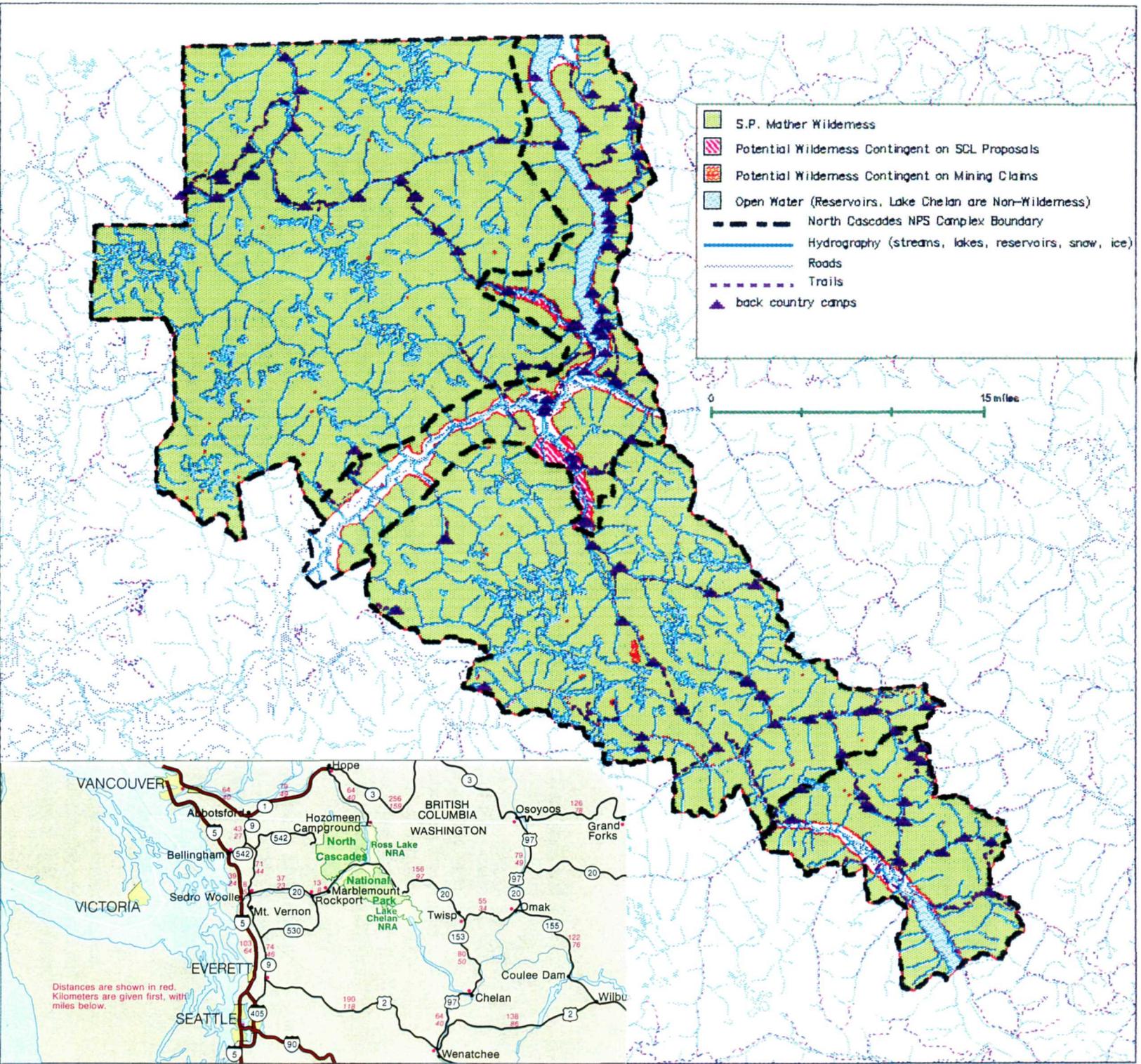
Area	Gross Acreage	Designated Wilderness	Percent Wilderness	Potential Wilderness
North Cascades National Park	505,000	504,614	99%	226
Lake Chelan NRA	62,000	56,000	90%	5,000
Ross Lake NRA	117,000	74,000	63%	0
Total Complex	684,000	634,614	93%	5,226

The Stephen Mather Wilderness was named in honor of Stephen Tyng Mather, first director of the National Park Service. It is at the core of one of the wildest, largest and least altered ecosystems remaining in North America. The Stephen Mather Wilderness is surrounded by 6 million acres of National Forest lands, of which 1.4 million acres are designated wilderness. To the east are the 505,524 acre Pasayten Wilderness and the 145,667 acre Chelan/Sawtooth Wilderness. To the south is the 576,865 acre Glacier Peak Wilderness. To the west is the 117,900 acre Mount Baker Wilderness and the 14,400 acre Noisy-Diobsud Wilderness. To the north in Canada are the Skagit Valley Recreation Area, British Columbia forest lands, and just to the east, Manning Provincial Park.

The Stephen Mather Wilderness is at the crest of the North Cascades mountains and is characterized by rugged peaks, ridges, slopes, alpine meadows, 200+ lakes, 300+ glaciers, and countless waterfalls. Because valley bottoms, river basins and lower elevation habitats only make up a small percentage of its area, the Stephen Mather Wilderness does not adequately protect the complete ecosystem or biodiversity of the region.

There has been no change in the wilderness boundaries since the wilderness legislation of November 16, 1988 and no changes are proposed at this time. There are 5,226 acres of potential wilderness in the Complex. These lands possess wilderness character but are prevented from wilderness designation by encumbrances including patented mining claims, potential plans for flooding due to the construction of the High Ross Dam, and the existence of a road.

STEPHEN MATHER WILDERNESS Wilderness and Proposed Wilderness Boundaries



Section 2: Status of Wilderness Related Plans



Wilderness Management Plan

The Wilderness Management Plan for the Stephen Mather Wilderness was approved on March 20, 1989. The Plan introduced the Limits of Acceptable Change (LAC) model as a management tool for this wilderness. LAC is a planning procedure that consists of a series of interrelated steps leading to the development of a set of measurable objectives that define desired wilderness objectives and desired wilderness conditions. It also defined management actions necessary to maintain or achieve desired conditions. The Wilderness Management Plan adopted management strategies designed to control human caused change to the resources and the quality of the wilderness experience. These included:

- Physical design standards - trails, bridges, signs, compost toilets, hardened campsites
- Education and information
- Mandatory permit system with fixed itineraries
- Restrictions - party size limits, campfire restrictions, camping setbacks from trail and water, zoning

The Wilderness Management Plan adopted the existing trail network and many of the existing backcountry recreational use practices such as permit requirements, designated camping restrictions, and party size limits. A mandatory permit system helps to disperse use, shift camping away from sensitive and impacted areas, and promote minimum impact camping techniques. A network of 300+ miles of maintained trails and 200+ designated campsites were hardened to absorb use and protect more sensitive areas. Pit toilets and composters help to control human waste and protect groundwater from contamination.

A limited monitoring program was established to measure impacts and evaluate change to camps in order to select the management action necessary to maintain or achieve desired conditions. A native plant nursery propagates sub-alpine plants to help to restore severely impacted areas.

The Wilderness Management Plan needs major revision to include:

- Appropriate attention to all the values of wilderness - recreational, scenic, scientific, conservation, educational and historical.
- Ecosystem approach - Wherever possible, adopting joint management practices with adjacent public lands - visitor use management strategies, permit procedures, standards for resource and social conditions, common impact monitoring databases and indices, minimum tool guidelines, and public information programs.

- Application of Geographic Information System (GIS) technology.
- Application of ecologically based indicators and resource standards.
- Identification of appropriate actions to manage recreational activities not addressed in the current plan, such as day, climbing, and commercial use.
- Reevaluation of trail systems and camps in relation to sensitive natural and cultural resources.
- Linking visitor use management strategy to results of the University of Idaho's analysis of NOCA's long-term impact monitoring data.
- Preparation of an Environmental Assessment and public review.

Revising the park's Wilderness Management Plan is a top priority in the Resource Management Plan and request for Natural Resource funding for FY95.

Climbing Management Plan

Climbing management will not be addressed in a separate plan but is an integral part of NOCA's Wilderness Plan. Mountain climbing and cross-country use has increased significantly in recent years and is presently estimated to be 6,500 visitor nights annually. Climbs in the North Cascades are in remote locations that generally involve a lengthy approach through forest, a traverse across subalpine zones, crossing of snow or glaciers, and a scramble or climb on rock. There are few fixed anchors or bolts and there are no identified problems with excessive chalk, motorized rock drills, gluing or chipping rock to reinforce hand and foot holds. The greatest impacts appear to be human waste, soil compaction, erosion, vegetation damage, and wildlife disturbances primarily on the approach, descent routes, and bivouac sites. Prior to 1993, the monitoring of impacts has focused on maintained trails, established camps, and the most popular and heavily impacted sub-alpine meadows. A limited program to inventory the impacts in the cross-country zones was initiated in 1993, but the extent and trends of these impacts are not yet well understood. There has been minimal monitoring of impacts to cross-country zones and climbing areas.

Restoration Management Plan

The NOCA *Restoration Management Plan* establishes policy and direction for mitigating and repairing impacts to vegetation and soils in the Stephen Mather Wilderness. It establishes specific for impact monitoring, plant propagation, and site restoration. The objectives of the plan are to:

- Provide direction to park personnel responsible for planning, directing, and funding the NOCA restoration program.
- Establish criteria to prioritize restoration projects.
- Ensure that restoration efforts protect the landscape ecology, maintain the genetic integrity of plant stock and preventing the introduction of exotic species.
- Establish long-term planning priorities, and develop cost-effective restoration procedures.
- Establish a planning process for projects, so materials, personnel and timing can be anticipated and budgeted.

Refer to Section 10, Restoration and Revegetation, for a detailed description of this plan.

Draft Aviation Management Plan

North Cascades National Park Service Complex is operating under a draft Aviation Management Plan that is currently under management review. Section 1133(c) of the Wilderness Act allows for the use of "aircraft necessary to meet minimum requirements for the administration of the area.... (including measures required in emergencies involving the health and safety of persons within the area)..." Aircraft are used for wildland fire, technical rescue, medical evacuation, resource management, animal control, and the servicing of fire lookouts, radio repeater sites, and remote sensing stations. The purpose of the Park Aviation Plan is to assure compliance with Departmental policy, NPS aviation management guidelines (NPS-60) and the Wilderness Act.

The aircraft use policy for the Stephen Mather Wilderness is that:

- Aircraft may only be used if stock use is not permitted on trails, trail conditions prevent use, or it is impractical to use stock and there is no other practical way to accomplish the work. Aircraft use will be confined to Monday through Thursday and as much as possible to before the 4th of July and after Memorial Day. Emergency Operations are exempt.
- In Crosscountry I Areas, aircraft must be used for emergencies and, to a limited extent for administration of the area. Administrative use will be limited as much as possible to a period before July 4 and after Labor Day and during weekdays of Monday through Friday.
- In Crosscountry II areas, aircraft use will be limited to emergencies and administrative use only. Administrative use must be requested and justified in advance; the Wilderness District Ranger or Chief ranger must approve all flights in advance. Flights should be strictly limited and a report of all landings will be made by the Wilderness District Ranger to the Superintendent at the end of each calendar year.
- Every effort should be made to minimize helicopter landings and all flights below 2000 feet above ground level (agl). When a flight is essential, the season, day of week, time, and flight path should be arranged to minimize impact on resources and wilderness users. Missions should be combined whenever possible to decrease the number of flights and for cost efficiency.
- NPS Management Policies specify that helicopters and airstrips are not permitted in wilderness areas, but natural openings may be used as helispots. Sites may only be marked or improved in conjunction with specific emergencies and must be restored after the emergency. Only the minimum tools necessary to successfully, safely and economically accomplish management objectives shall be permitted in designated wilderness areas. Specific approval by the Regional Director is required for all non-emergency administrative use of aircraft in wilderness areas below 2000 feet agl, unless the park has an approved General Management Plan and/or Wilderness Management Plan which covers these activities.

A helicopter\aviation permit is required for all NPS use of aircraft. A permit application is submitted to the Park Aviation Manager at least ten days prior to a flight. The application is reviewed by the Park Wilderness\Aviation Committee which includes the Assistant Superintendent, Wilderness District Ranger, Trails Foreman, and other appointed members. The committee determines whether an aircraft is the appropriate minimum tool essential to accomplish a project and approves or disapproves all requests. All flights that represent a new use not previously permitted in North Cascades are forwarded to the Superintendent for review.

Resource Management Plan

The purpose of a Resource Management Plan is to describe a comprehensive program for protection of the park's natural and cultural resources. NOCA's Resource Management Plan was approved in January 1994. There are 32 project statements that directly relate to wilderness resources:

Atmospheric Resources

- NOCA-N-25 Visibility Monitoring
- NOCA-N-18 Acid Precipitation Monitoring
- NOCA-N-08 Air Pollution Impacts on Biota
- NOCA-N-36 Monitoring for Climate Change

Geologic Resources

- NOCA-N-40 Sediment and Erosion Control
- NOCA-N-39 Quaternary Geology, Landform, and Soil Mapping

Hydrologic Resources

- NOCA-N-16 Management of Natural Lakes
- NOCA-N-26 Water Quality - All Waters

Biological Resources - Vegetation

- NOCA-N-06 Native and Non-Native Forest Insects and Disease
- NOCA-N-09 Management of Exotic Plants
- NOCA-N-10 Rare, Threatened, Endangered, Sensitive Plants
- NOCA-N-28 Vegetation Impact Monitoring and Rehabilitation
- NOCA-N-38 Vegetation Response to Climate Change

Biological Resources - Wildlife

- NOCA-N-17 Fisheries: Rivers and Tributaries
- NOCA-N-20 Rare, Threatened, Endangered, Sensitive Mammals
- NOCA-N-21 Rare, Threatened, Endangered, Sensitive Birds
- NOCA-N-22 Problem, Species Management
- NOCA-N-23 Ungulate Ecology and Management
- NOCA-N-34 Management of Native Herpetological Populations

Ecosystem Management

- NOCA-N-02 Natural Fire Management
- NOCA-N-03 **Wilderness Management**
- NOCA-N-07 Impacts from Adjacent Land Use
- NOCA-N-11 Resource Baseline Inventory and Monitoring
- NOCA-N-37 Management of Wetlands
- NOCA-N-24 Administrative Practices
- NOCA-N-31 Aircraft Use Management

Cultural Resources

- NOCA-C-01 Prehistoric Archeology
- NOCA-C-02 Historic Archeology
- NOCA-C-03 Inventory and Evaluate Ethnographic Resources
- NOCA-C-05 Document and Manage Historic Structures

Interdisciplinary Project Statements

- NOCA-I-01 Document, Preserve, and Augment Museum Collection
- NOCA-I-02 Information Management Systems

Project NOCA-N-03 justifies the need for revising the current *Wilderness Management Plan* along with an Environmental Assessment. It recommends three actions in priority order:

NOCA-N-03.01 Continue to implement the Wilderness Management Plan. Contact maximum number of visitors in the cross-country areas and provide information regarding minimum impact practices and safety. Remove fire rings and clean-up litter. Initiate corrective action including revegetation of impacted sites or closure to camping, as appropriate. Compile baseline information on cross-country use areas to enable management to detect changes. Enforce backcountry regulations such as camping location, party size and livestock use to ensure resource protection. No new regulations are considered. Training is needed in backcountry and wilderness management techniques

for all staff. This will be completed on a Regional basis and through interagency cooperation. Funding is requested for two additional seasonal rangers to enhance backcountry patrol and wilderness information.

NOCA-N-03.02 Bring wilderness camps up to standards established in Wilderness Management Plan. Corrective measures to rehabilitate damaged vegetation at camps will be initiated immediately. Additional trail laborers will be hired. Sites will be surveyed and relocated as required by the Complex standards. Existing data concerning camping use patterns must be thoroughly scrutinized. Study results may lead to elimination of some sub-standard camps entirely. It will take at least five years to complete the work, dated from the time the funding is granted.

NOCA-N-03.03 Research campfire impacts. Determine impacts of campfires and wood gathering on soils, vegetation, air quality, aesthetics, and other resource values.

Fire Management Plan

The NOCA Wildland Fire Management Plan was approved in August 1991. A primary objective of the plan is to "provide for continuation of the natural role of fire in the ecosystem to the extent possible, consistent with the protection of life, property, cultural resources, adjacent land values, and air quality." The plan provides for prescribed natural fire and management ignited prescribed fire. Natural ignitions may be allowed to burn if they are within prescription parameters and located within the prescribed natural fire zone which generally corresponds to the area designated as Wilderness. Air quality impacts are considered for all fire management actions; within Prescribed Natural Fire Zones the natural process of fire and smoke are allowed to the fullest extent possible consistent with protection of populated areas.

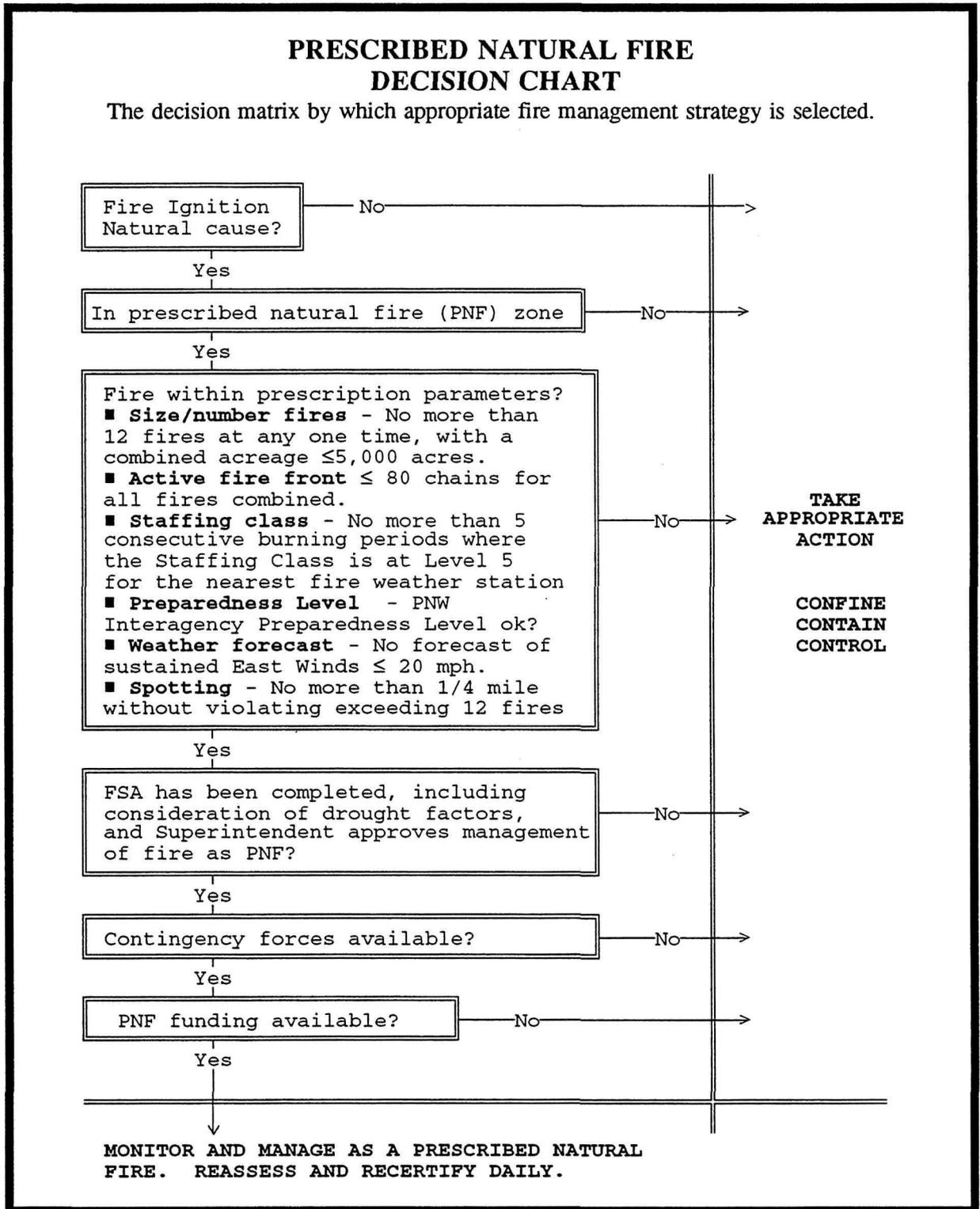
If a fire is clearly human caused or an immediate threat to life or property, suppression action is immediately initiated. The methods used should be those that will have the least impact on the environment. Where feasible, indirect methods of attack utilizing natural barriers are preferred.

If fire has the potential to be classified and managed as a Prescribed Natural Fire, the Fire Management Officer assembles a Team to prepare a Fire Situation Analysis and make a recommendation to the Superintendent about whether the fire should be confined, contained, controlled, or monitored and managed as a prescribed natural fire. The Fire Situation Analysis Team, made up of the Fire Management Officer, Chief of Resources Management, District Resource Management Specialist, Chief Ranger, and Wilderness District Ranger:

- Insures completion of Fire Situation Analysis, and signs Parts I and II.
- Provides for monitoring of fire activity.
- Considers natural and cultural resource protection and fire behavior concerns. Contacts archaeological staff for assessment of prehistorical or historical values at risk.
- Assesses risks to rare and endangered species, wildlife habitat, and watershed values.
- Assesses air quality situation. Evaluates potential impacts from smoke. Advises if smoke is affecting or will affect populated areas, Class I areas, and important vistas.
- Considers management concerns and priorities; protection of life and property; impacts to visitors, neighbors, and community; political considerations; and protection of wilderness values.

The plan provides for the utilization of minimum impact suppression actions to protect natural resources. The decision about what action to take on a fire is determined by following the Fire Management Decision Chart found in Figure 2-1.

Table 2-1: Fire Management Decision Chart



Interpretive Prospectus

The Interpretive Prospectus was approved in February 1990. The first of six listed themes that the interpretive program is designed to convey is wilderness:

Wilderness and its value to individuals and society: Wilderness provides a link with the natural order, of which we are part and from which we can draw inspiration and meaning. Visitors will be encouraged to reflect on their personal experiences in the North Cascades and how that shapes their own relationship with nature.

Providing education about the value of wilderness and how to minimize impacts is a major goal of all NPS and joint NPS\USFS information stations. Wilderness is listed as a primary theme of the North Cascades Visitor Center. One of the two primary audio-visual programs is a 16mm motion picture entitled "Return to Wilderness." Its primary themes are the spiritual impact of witnessing the wilderness backcountry and nature's return to a wild state through preservation and active resource management technologies. It emphasizes the management and visitor partnership responsible for minimizing man's impacts and preserving the pristine character of wilderness values.

Section 3: Ecosystem Management Issues and External Threats



Major Existing and Emerging Ecosystem Management Issues

Habitat Fragmentation and Loss of Biodiversity

Historic and contemporary land use within and adjacent to the North Cascades Mountains has, in many instances, substantially modified both the landscape and resource base that existed prior to European-American settlement of northwestern Washington and southern British Columbia. The net effect of these land use activities has been to establish a diverse range of land development and resource utilization strategies within the North Cascades ecosystem, some of which are detrimental to the purposes of the Wilderness. The burgeoning population adjacent to the Stephen Mather Wilderness is substantially modifying the natural landscape and isolating wilderness as a natural resource island.

Since 1960, the population in Washington's Puget Sound region has grown an average of 19.6 percent per decade. In 1990 the population reached 3.5 million in a 12 county area. It is projected that a total of 5.1 million people will reside in the Washington State portion of the Puget Sound Region by the year 2020 (Washington Office of Financial Management). Vancouver, British Columbia, is the fastest growing city in Canada, and has a current population of more than 1.6 million people with nearly 3 million people inhabiting the greater metropolitan area. Clear-cutting of old growth and late-successional forests, road construction, urbanization, increased traffic, and housing construction and development are fragmenting the ecosystem and causing a decline in the population and genetic variability of native species.

The increasing population is modifying water resources and causing a decline in anadromous fish due to the channelization of rivers and streams, loss of riparian area and wetlands, and increasing water pollution, water temperature, and soil erosion/siltation. Fragmentation of habitat creates barriers that restrict the range, movement, and dispersal of species. It reduces the genetic variability of species, leaving them susceptible to extinction caused by environmental catastrophes. Increased exposure to foreign environments leads to an increase in exotic plant and animal species. In 1976 and 1982, 258 exotic plant species were documented in or near the Complex.

Degradation of Air & Water Quality

Under the Clean Air Act of 1977, the Stephen Mather Wilderness is a Class I area and the non-wilderness Recreation Areas are Class II. NOCA has limited long-term data on air quality, visibility, ozone, acid precipitation, and water quality for the Stephen Mather Wilderness. Obtaining baseline and long-term monitoring data on air and water quality is among the park's top priorities. The potential for deterioration of pristine air and water quality is high because the Complex lies in the path

of prevailing westerly winds blowing across the large urban-industrial area that extends from Portland, Oregon, north to Vancouver, British Columbia. The major point sources of air pollution from factories and industry that are closest to the Stephen Mather Wilderness are listed in Table 3-1.

Table 3-1: Distance from Wilderness to Major Point Sources of Air Pollution

City/Development	Distance	
	Miles	Kilometers
Bellingham	41	67
March Point	47	75
Ferndale	48	77
Everett	51	82
Cherry Point	54	86
Port Townsend	65	104
Vancouver, B.C.	73	118
Seattle	85	136
Port Angeles	96	154
Tacoma	102	163
Centralia	150	241

Acid precipitation could be a problem in the future partly due to the very poor buffering capability of soils and rocks in the Cascades. Eight years of monitoring data is available indicating the precipitation pH has remained at the lower limits (4.9 pH) of natural variability. This indicates that it is likely that pH is being influenced by human activity. There is little data regarding air movement in the Pacific Northwest related to transport of pollutants. Studies of heavy metals indicate relatively high concentrations in mountain goat hair in the North Cascades. Discussions with the University of British Columbia, Victoria, B.C., indicate a recently determined phenomenon in the Fraser River valley with an offshore breeze that holds ozone levels in the valley to unusually high levels. The combination of offshore breeze and the surrounding mountains creates a "bowl" effect that holds and allows ozone and pollutants levels to elevate. This then circulates through the tributary valleys of the Fraser River and into the Stephen Mather Wilderness.

Puget Sound is among the fastest growing metropolitan areas of the country. Non-point sources of pollution, especially automobiles, are increasing at an alarming rate. Impacts from non-point source pollution include decreased visibility in Class I areas, increased levels of phytotoxic gases, acid deposition, and degradation of water quality.

All land and surface waters of the Wilderness are exposed to air pollutants from various sources. Various chemical pollutants such as sulfur dioxide, nitrous oxide, carbon monoxide, ozone, lead, arsenic, fluoride, and some pesticides, enter the aquatic ecosystem as either acid precipitation or dry particulate deposition. Sensitive terrestrial and aquatic ecosystems, especially those occurring at high elevations, can be degraded by existing or future pollution. Preliminary data collected and analyzed in the Cascades indicates that the dilute (low mineral concentration) nature of lakes and other surface waters makes them especially sensitive to pollutants - particularly acidification by nitrogen and sulphur. In addition to direct impacts on water quality and organisms, acidification can cause mobilization of toxic compounds such as aluminum and mercury. Other pollutant threats include metals (Hg and Cd) and organic compounds (pesticides and polynuclear aromatic hydrocarbons). Logging in southern British Columbia and on non-wilderness forest lands in the United States may result in water pollution (siltation, pesticides and herbicides) problems in the Skagit River and Bridge

Creek watersheds. Acid mine wastes from a 120 acre private mining claim in the upper Thunder Creek watershed could cause the contamination of surface waters.

Impact by Recreational Users

Regional population growth is creating increased visitor use of the Wilderness. Over 500,000 visitors a year drive through the Complex via Highway 20. Okanogan National Forest plans call for development of campgrounds, a visitor center and other facilities at the headwaters of Bridge Creek along Highway 20. Increased visitor use brings non-point source air pollutants into the Complex and degrades water quality at campgrounds and rest areas.

Recreational use has many, often cumulative, on wilderness resources. These effects can result in overall degradation of the integrity of the wilderness resource. Perhaps the most easily observed effects are those to vegetation and soils. Human activity can cause plant damage and loss, changes in plant community composition toward more trampling-resistant species, invasion by exotic plant species, threats to rare species, and soil erosion and compaction. Visual "scars" detract from the Wilderness Act's definition of wilderness as "untrammelled by man". Fire kill vegetation and alter soil chemistry. Wildlife population levels, habitat use, and interspecific relationships can be altered by availability of human generated sources of food.

The Wilderness has over 300 miles of trails which usually follow stream corridors and lead to high mountain lakes. There are a variety of effects on terrestrial, riparian and aquatic habitat associated with recreational use along trails and in cross-country travel zones. These include water quality impacts from human waste disposal, vegetation impacts from campsites and campfires, and erosion from trails. Wildlife can be disturbed during critical periods. Administrative activities such as trail and wilderness camp maintenance can also cause impacts. In the past, unregulated use of certain camps by large stock parties has adversely impacted natural vegetation. Increased erosion, scarred and weakened trees from improper tethering, denudation of large areas and the introduction of non-native plants has ensued.

Global Climate Change

Human induced climate change is potentially one of the most pervasive and serious threats facing the Stephen Mather Wilderness. Most researchers suggest a 4-9 degree (F) rise in mean global temperature in the next century is likely due to atmospheric loading of greenhouse gases. Even a change of few degrees in the average annual temperature of the Pacific Northwest could have significant effects on the natural function of natural ecosystems. Examples of broad scale changes that would directly affect components of aquatic ecosystems would include change in fire regime, increased occurrence of forest diseases and insect pests, accelerated melting of glaciers, lower stream discharge, extended growing seasons and drought, rises in treeline, extinction of species unable to shift their range quickly enough, and changes in species distributions and associations. Independently these changes could have drastic impacts on the ecosystems. When combined with synergistic effects from other threats, global climate change could trigger devastating changes to the wilderness.

Interagency Cooperation to Address Ecosystem Management

Lower Fraser Basin/North Cascades Fire Management Ecosystem Group

NOCA met with other land managers from provincial, federal, and state agencies in January 1993 to explore the concept of ecosystem fire management for lands in the Lower Fraser Basin and the North Cascades. There was mutual interest in improving efficiency, cost effectiveness and ecological benefits through a coordinated fire management program. Information was gathered about the mandates and fire management programs of the participating agencies through interviews, site visits, workshops and a review of written policies. On 9/24/93, NOCA signed a charter with British Columbia Ministry of Forests, British Columbia Ministry of Environment, Washington Department of Natural Resources, and Mount Baker-Snoqualmie National Forest agreeing to work cooperatively "to improve interagency wildland fire management coordination, cooperation, and planning in an efficient and cost effective manner and to achieve individual agency land management objectives in the Lower Fraser Basin/North Cascades ecosystem across jurisdictional boundaries."

During 1993 the group assembled information about the mandates and fire management programs of each agency. It also examined fire management concerns and identified several areas where increased coordination among the agencies could improve efficiency and cost effectiveness. Sub-committees are continuing to work on: drafting a joint resource guide; comparing qualification systems; developing cross-training opportunities; developing a single fire agreement; improving billing procedures between agencies; developing an information outreach plan; and expanding the exchange of land management information. The products of these subcommittees were exchanged at a workshop in 1994.

Greater Northern Cascades Ecosystem

Discussions and strategies for protecting the North Cascades Ecosystem (which stretches from the Fraser River in British Columbia to Snoqualmie Pass in Washington) have been advanced for decades. The international treaty which resolved the High Ross Dam controversy and established the Skagit Environmental Endowment Commission directs the Commission to consider the establishment of an International Park. The 1988 GMP recommended that the Park Complex become the core of a protected regional ecosystem and that discussions about an international park be initiated with British Columbia. Alternative strategies discussed have included establishment of an international park and a biosphere reserve.

In 1992, the Cascades International Alliance, an alliance of eleven conservation groups from the United States and Canada led by the National Parks and Conservation Association, organized to promote the establishment, protection, and management of a transboundary North Cascades Ecosystem and International Park. On March 25-27, 1994, the National Parks & Conservation Association coordinated a *Nature Has No Borders* Conference at the University of Washington "to develop international cooperation in managing the biologically diverse Northern Cascades ecosystem shared by Canada and the United States." Several hundred participants from both countries attended workgroups and presentations by Congressman Bruce Vento, Assistant Secretary of the Interior George Frampton, and Commissioner Stephen Owen, Commissioner on Resources and the Environment. No formal action has been taken nor has any specific proposal been advanced since the conference.

Interagency Grizzly Bear Committee (IGBC)

Historically the grizzly bear occupied most of Washington but by the 1950's indiscriminate hunting and habitat loss reduced the population to the brink of extirpation. Since 1988 the U.S. Fish and Wildlife Service has headed an interagency effort to identify the historic range and population of grizzly bears in the North Cascades and to determine if there was a population of grizzly bears in the ecosystem. In December 1991, the Interagency Grizzly Bear Recovery Committee released their

findings that "there was a small, resident, widely distributed, and reproducing population in the ecosystem." Washington Department of Wildlife biologists estimate the size of the population in the North Cascades Range at 10 to 20 grizzly bears. Based on this work, the U.S. Fish and Wildlife Service released a grizzly bear Recovery Plan which identified six potential recovery areas, the largest one being the North Cascades ecosystem. In November 1993, a draft Recovery Plan for the Northern Cascades ecosystem was released for public review. A series of public meetings was conducted that revealed passionate pro-grizzly-recovery and anti-grizzly opinions. Finalization of the Recovery Plan will follow analysis of over 500 written responses from the public and should be completed in 1994.

Gray Wolf Recovery

Historically, wolves ranged throughout the state but were probably extirpated by the early 1900's. Reported sightings in the upper Skagit Valley have increased over the last two decades. Currently, it is believed that as many as six wolf packs inhabit the Washington North Cascades. Packs have been reported from the Canadian border within the North Cascades NPS Complex to Mount St. Helens. Three packs were documented in 1990 in the North Cascades area. Pups and adults were seen or heard in the Complex near the Canadian border, and in the Okanogan and Wenatchee National Forests. Additional reports of individual wolves likely indicate a natural recolonization of wolves into Washington from Canada. The species is listed as "endangered" in the contiguous 48 states (except Minnesota) under the Endangered Species Act. In 1990, an Interagency Steering Committee was formed to facilitate cooperative research, monitoring, public information and agency activities in Washington. This group will contribute to formulation of a recovery plan by the U.S. Fish & Wildlife Service. A Research and Management Subcommittee of the Interagency Steering Committee is preparing a draft set of management guidelines which will be submitted to the Steering Committee in 1994.

Forest Ecosystem Management Assessment Team

The National Park Service and the other federal land management agencies in the Pacific Northwest have been involved during the past year in an important effort in cooperative federal land management. This involves a plan for the management of forest lands across agency jurisdictions within the range of the northern spotted owl: "the President's Forest Plan."

The plan identifies seven land allocations from northern California to the Canadian border, west of the Cascades. Although not specific to wilderness areas alone, the success of the plan depends on the presence of national parks, wilderness areas and other Congressionally reserved areas and the ecosystems they harbor. The National Park Service is an important player in this effort to develop a more sustainable relationship between people and the environment across a diverse landscape.

North Cascades and other affected parks in the region are working with their counterparts in other agencies in implementing the Forest Plan at the field (physiographic province) level. These interagency "Province Teams" consist of representatives of federal agencies, states, tribes, and others. The Province Teams work on the local level to carry out watershed analysis and restoration efforts, as well as other implementation projects. Park areas directly involved in interagency Province Teams are Crater Lake, Mount Rainier, North Cascades, Olympic, Oregon Caves, and Redwoods.

Canada

The Skagit Provincial Park Recreation Area adjoins North Cascades National Park/Ross Lake National Recreation Area and Manning Provincial Park is just to the east of the boundary. Numerous cooperative efforts have been conducted or are ongoing. They include:

- Gray Wolf Study and Recovery Plans
- Grizzly Bear Study and Recovery Plans
- Law Enforcement (particularly customs violations)
- Search & Rescue
- Wildland Fire Suppression
- Wildland Fire Management Planning
- Planning Infrastructure and Facility Needs at Hozomeen
- Trail Maintenance
- Solid Waste Disposal
- Staff Exchanges
- Consultation regarding Skagit Drainage Archeology
- Technical Assistance to the Nlakapamux (Lower Thompson Tribe)

In addition to the National Park Service and British Columbia Parks Department, cooperating agencies/organizations include: U.S. Forest Service, B.C. Forest Service, B.C. Ministry of Environment, B.C. Transportation Department, Washington Department of Wildlife, U.S. and Canada Customs, Royal Canadian Mounted Police, B.C. Provincial Archeologist, Washington Department of Natural Resources, Seattle City Light and the Student Conservation Association.

The Skagit Environmental Endowment Commission was established by international treaty in 1984 ratifying an agreement between the City of Seattle and the Province of British Columbia. The Commission administers an endowment to fund projects in the upper Skagit area that enhance and protect recreational opportunities and natural/cultural resources. Managers and scientists from the United States and Canada regularly confer while preparing grant requests for the Commission.

The Superintendent meets regularly with the Forest Supervisors and other park Superintendents from western Washington. Staff from the Park and the adjacent three National Forests regularly communicate on common wilderness issues. This communication occurs through telephone calls, meetings, cross-attendance at training sessions, and field trips. The Park and Forests share resources on a variety of tasks such as trail construction and maintenance, the staffing of the Sedro Woolley, Glacier, and Chelan public contact stations, issuance of Park camping and grazing permits, and minimum impact education. Backcountry and trail conditions reports are distributed between the units on a weekly basis during the summer season.

Skagit Environmental Endowment Commission (SEEC)

In 1984, the United States and Canada ratified a treaty stipulating that the City of Seattle would not raise Ross dam for eighty years in exchange for power purchased at rates equivalent to what would have resulted from raising the dam. One of the terms of the agreement between the City of Seattle and British Columbia created a unique endowment "to conserve and protect wilderness and wildlife habitat" and to "enhance recreational opportunity" in the upper Skagit watershed above Ross dam. An endowment fund that will last for eighty years is managed by an eight member commission, four Canadian and four U.S. members.

The mission of the Skagit Environmental Endowment Commission is to foster protect of the biological integrity of the upper Skagit watershed. It encourages international cooperation in the stewardship of

these lands and waters and facilitates dialog among management agencies, non-governmental organizations, citizens, local governments.

Between 1985 - 1993 the SEEC awarded nearly 3.3 million dollars in grants for 125 projects. Grants directly awarded to the NPS for the Stephen Mather Wilderness include Whatcom Pass revegetation, Hozomeen Lake Camp rehabilitation, printing grizzly bear and gray wolf brochures, preparing a Hozomeen wildland fire management plan, conducting a survey of rare and endangered raptors, and completing a gray wolf study. The Little Jack and Desolation wilderness camps are currently being rehabilitated and brought up to Wilderness Management Plan standards.

Section 4: Wilderness Resource Conditions, Trends & Impacts



In the 1993 *Annual Report to Congress on the Wilderness Management*, the general resource conditions and trends for the Stephen Mather Wilderness were summarized as:

Table 4-1: Resource Conditions, Trends & Impacts

Resource	Condition				Trend			
	Good	Fair	Poor	Unknown*	Improving	Deteriorating	Stable	Unknown*
Air		X				X		
Soil				X				X
Water	X					X		
Vegetation	X					X		
Wildlife				X				X
T & E Species-Flora			X					X
T & E Species-Fauna				X				X
Natural Fire Regime		X			X			
Archaeological Sites		X				X		
Historic Structures			X			X		
Heritage Values**				X				X
Solitude	X						X	
Primitive Recreation Opportunities	X						X	

*(Unknown includes insufficient data and no data)

**Heritage Values--A specific value that an identifiable user group relates to.

Air

Only minimal baseline data has been collected and analyzed on the air quality of the Stephen Mather Wilderness. The major internally generated impact on air quality is from prescribed natural fires and prescribed burns. The decision criteria controlling these activities carefully considers potential impact on air quality-related values, e.g., visibility. The northern Cascade Range is experiencing significant air pollution from vehicles, industry, and other sources from Vancouver, B.C., to Portland, Oregon. Subalpine fir and ponderosa pine are known to be sensitive to air pollutants; it is possible that sulphur dioxides, nitrous oxides and heavy metals may be impacting vegetation. A study of the impacts on subalpine fir and lichens from air pollution is underway.

Visibility impairment in the Northwest is often attributed to natural causes, i.e., fog and low clouds, or fires, i.e., slash burning, or wild or prescribed forest fires. However, impairment from human caused aerosols is also documented. Monitoring of visibility is underway at Ross Lake and Stehekin.

Soil

Little research has been conducted on soils in the Stephen Mather Wilderness. Soils types in the Complex are very diverse because of the variety of topographic settings, parent materials, vegetation, climatic regimes, and the age of landforms. Parent materials include alluvium, glacial drift, landslide deposits, volcanic ash deposits, and bedrock. Soils on steep bedrock slopes and in alpine areas are thin and poorly developed. Soils formed in glacial drift and alluvium on valley bottoms are thickest and best developed.

Soils types are a fundamental component of physical systems and ecosystems. At present less than 5% of the park area is covered by soil maps. The U.S. Environmental Protection Agency estimates that sulfur and nitrogen compounds account for the majority of the excess acidity in Washington's precipitation. Long-term deposition of elevated levels of nitrogen compounds may affect soil microbiology.

Water

The Wilderness contains portions of four major river drainage basins. The largest of these is the Skagit. Others major river drainages are the Chilliwack, Nooksack, and Stehekin. There are approximately 230 natural lakes in the Complex ranging in size from a fraction of an acre to 160 acres. Most drainage headwaters are contained entirely within the Complex and are not subject to contamination from outside areas. However, the waters are subject to acid deposition and impact from other air pollutants.

There is no estimate of stream habitat. Map inventory of stream and river habitat as well as riparian habitat has recently been initiated. It appears that water quality is generally very good although it is likely that impacts are occurring from regional air pollution. High elevation lakes may be particularly susceptible to these impacts. Limited monitoring programs are on-going on some waters. Giardia has been found in some surface waters.

In 1993, a proposal submitted by North Cascades was selected as the National Park Service's long-term ecological monitoring prototype for lakes and waters. Analysis of the condition of aquatic systems requires a watershed context because these systems integrate key landscape components including glaciers, landforms, stream channels, lakes, wetlands, riparian zones, and upland areas. Watershed condition is reflected in the distribution and types of seral classes of vegetation, land-use history, effects of previous natural and land-use related disturbances, and distribution and abundance of species. Achievement of goals and objectives requires a monitoring program that integrates various

spatial scales through time to analyze or index natural processes and human-induced perturbations. In 1990, a study by Noss proposed a general guideline to be followed in monitoring programs which proceeds from the top down, beginning with a coarse-scale inventory of landscape pattern, vegetation, habitat structure, and species distributions, then overlaying data of stress levels to identify impairment.

The monitoring program follows a watershed approach that tracks upslope processes and conditions but places emphasis and enhanced resolution on aquatic/riparian habitat and communities. The monitoring program emphasizes the role of disturbance and the importance of disturbance events on the condition or ecological integrity of the landscape and aquatic systems. This program will provide valuable watershed baseline or reference information for implementation of the President's Forest Plan.

Vegetation

Great variation in vegetation exists due to dramatic differences in rainfall, slope, and elevation. As of 1988, 1,577 vascular plant species have been identified. Fire suppression, air pollution, and recreational activities are likely affecting vegetation.

A vegetation map of the Complex was prepared in 1985 by the University of Washington Cooperative Park Study Unit for fuel map modelling and was digitized into a geographic information system. The data was interpreted from LANDSAT which has a 50 meter by 50 meter resolution with 85% accuracy. At this time, more detailed vegetation mapping is only available for the Stehekin Valley. It was compiled at 1:6,000 and has been digitized into the geographic information system.

Table 4-2: Vegetative Cover Types within Park Complex

	%	Acres
Ponderosa pine (open)	0.2	1,300
Subalpine fir (open)	4.0	27,300
Whitebark pine/Subalpine larch (closed)	0.7	4,700
Pacific silver fir (open)	3.4	23,200
Douglas-fir (closed)	9.7	66,300
Subalpine fir (closed)	6.2	42,400
Mountain hemlock (open)	2.6	17,700
Western hemlock (closed)	8.8	60,100
Pacific silver fir (closed)	8.9	60,800
Mountain hemlock (closed)	4.1	28,000
Douglas-fir (open)	4.6	31,400
Whitebark pine/Subalpine larch (open)	0.7	4,700
Western hemlock (open)	3.6	24,600
Lush herb	9.3	63,600
Lowland grass	1.6	10,900
High shrub	4.9	33,500
Hardwood forest	0.4	2,700
Heather meadow	0.6	4,100
All other	25.8	176,400
TOTAL	100	684,000

Impacts on vegetation are caused by fire suppression, air pollution, and recreation. Past and current fire suppression may alter the fire regime and cause hazardous accumulations of fuel that could lead to unwanted, potentially catastrophic, wildfire occurrence; and/or unnatural changes in forest stand composition and wildlife habitat. In addition, suppression techniques can cause resource damage by killing vegetation, causing erosion, and

impacting aesthetic values. Prescribed natural fire is an active part of management action. Air pollution impacts from such pollutants as sulphur dioxides and nitrous oxides may be impacting vegetation.

In some high use areas, backcountry hikers and climbers cause soil compaction, trampling of plants, erosion from trails and shortcutting, killing of plants by campfires and campsites, and chopping down of trees for firewood. In the past, commercial grazing and the unregulated use of certain camps by large stock parties have adversely impacted natural vegetation. Increased erosion, scarred and weakened trees from improper tethering, denudation of large areas, and the introduction of non-native plants has ensued.

The park employs many strategies to minimize and mitigate these impacts including a revegetation program to restore impacted sub-alpine areas with nursery grown native species. All wilderness revegetation follows the guidelines of the park Restoration Management Plan.

Wildlife

The variety of habitats in the Wilderness support an estimated 337 species of wildlife. Common species include mice, shrews, voles, pikas, squirrels, beaver, marmot, porcupine, rabbit, cougars, bobcat, coyote, fox, black-tail deer, mule deer, mountain goat, and black bear. Bird species are numerous; however, the majority remain in the area only part of the year. Migratory birds stop to use habitat such as ponds, lakes, and rivers to feed and rest. Wildlife species that are rarely seen and whose population status is uncertain include wolverine, fisher, marten, lynx, moose, Rocky Mountain elk, American white pelican, trumpeter swan, sandhill crane, osprey, spotted owl, great gray owl, and barred owl.

The National Park Service participates with other agencies such as Washington Department of Wildlife, Washington Department of Fisheries, U.S. Fish and Wildlife Service, and U.S. Forest Service in a variety of wildlife studies including but not limited to:

Bald Eagle census	Mountain Goat studies
Spotted Owl surveys	Spawning surveys
Insect surveys	Peregrine Falcon surveys
Fish surveys - stream	Osprey surveys
Fish surveys - lakes	Songbird - inventory & monitoring
High lakes study - fish and amphibians	

The primary focus of these projects is to:

- assess the status and monitor sensitive indicator species, e.g., osprey
- to assess habitat and work toward restoration of a viable population of endangered species, e.g., grizzly bear
- to monitor species of special interest, e.g, mountain goat
- to prevent destruction of habitat of any native species.

Threatened or endangered wildlife species known or suspected in the area include: gray wolf, grizzly bear, peregrine falcon, bald eagle, and spotted owl.

Exotic animals have not been a problem with the exception of fish introduced into

naturally fish-free waters, e.g., natural lakes, or the introduction of non-native fish into waters with native fish, e.g., chinook in Lake Chelan. In the National Recreation Areas, where hunting is permitted, an important consideration is cooperating with the Washington Department of Fish and Wildlife in assuring that viable populations of game species are maintained.

Hunting is permitted within the 56,000 acres of Lake Chelan NRA and 74,000 acre of Ross Lake NRA that are designated wilderness. It is illegal to hunt or carry firearms in North Cascades National Park. Hunting is also permitted on most lands adjacent to the Wilderness. The Washington Department of Fish and Wildlife establishes hunting seasons for mule deer, elk, moose, and mountain goats within the Recreation Area wilderness. Accidental take and poaching do occur within the Wilderness. Little information is available to assess this problem.

Mule deer (*Odocoileus hemionus*) - Two subspecies of mule deer commonly occur within the Wilderness. The subspecies *O. h. hemionus* (mule deer) is found mostly from the Cascades crest east and the *O. h. columbianus* (black-tailed deer) is the common western Washington subspecies. These two subspecies readily hybridize; intergrades are common within the Wilderness. No data are available that estimates population size or density for either subspecies.

Elk (*Cervus elaphus*) - Historically elk were native to the western slope valleys of the northern Cascade Range. However, by the end of the 19th century, these populations had been nearly extirpated. During the first half of this century elk were reintroduced from the Rockies. Currently, a sizeable elk population exists adjacent to the Park Complex in the south and middle fork drainages of the Nooksack River. Occasional sightings of single animals or small groups of elk have occurred within the Wilderness.

Moose (*Alces alces*) - The North Cascades lie south and west of historical moose range. In the 1920's, Canadian biologists began noting a southward range extension of moose from populations in central British Columbia. Since establishment of the Complex, occasional observations of moose have occurred. The majority of these observations are concentrated in the upper Ross Lake basin.

Mountain goat (*Oreamnos americana*) - The mountain goat is distributed throughout the Wilderness. These goats occupy rock cliffs and subalpine meadows, though they often move to lower elevations during harsh winter weather. Population declines apparently have occurred, most conspicuously along the slopes above Lake Chelan. Herds there once numbered 300 - 400, but are now estimated at between 90 and 150. Reasons for this decline are unknown. Current knowledge is inadequate to determine actual status in the Wilderness.

Bighorn sheep (*Ovis canadensis*) - There is no clear evidence of occurrence of bighorn sheep within the Wilderness today. Apparently bighorns occurred in Okanogan County along and east of the Cascade crest, but were extirpated by the 1920's. In 1957, bighorns were reintroduced into Okanogan County. There are no sighting records in the Park's wildlife database, although there are several unconfirmed reports of sheep at or near Twisp Pass around 1910. Research has shown that Rocky Mountain sheep need a population of at least 100 individuals to survive.

The herpetological fauna of the Complex is comprised of approximately seventeen species in five orders. Very little quantitative data is available on the population status and distribution of these species within the Wilderness boundaries.

Fish

There are twenty-eight species and subspecies of fish present in the Wilderness. None of these is included on the U.S. Fish and Wildlife Service list of threatened or endangered species, although the bull trout is currently petitioned for Federal threatened and endangered species status. Anadromous runs of coastal cutthroat trout, Dolly Varden, steelhead trout, and 5 species of salmon occur in the Skagit, Nooksack, and Chilliwack drainages. The composition of the resident fish populations has been greatly affected by fish stocking and by impoundment of reservoirs, which has altered habitat and allowed fish migration above natural stream barriers.

The Washington Department of Fish & Wildlife (WDW) is primarily responsible for setting and enforcing sport fish harvest regulations in the Complex. The NPS assists in enforcement and consults with WDW regarding changes in fishing regulations. The NPS, by cooperative agreement with WDW, provides comments to WDW on existing and proposed fish harvest regulations, evaluates fish stocking programs, and approves or disapproves fish stocking proposals of WDW. The agencies cooperate in all research studies and management actions, such as angler use surveys and fish faunal studies.

All of the approximately 230 alpine lakes in the Wilderness were naturally fish-free. Most accessible lakes of significant size were stocked with non-native fish by interest groups and the Washington Department of Fish and Wildlife. All of these stocked lakes are within management designated natural zones and legislatively designated wilderness. NPS *Management Policies* (1988) specifically prohibits the stocking of non-native fish in natural zones. Since 1979 the NPS and WDW have negotiated a series of agreements providing a variance to the national policy. The most recent, signed in 1988, permits the continued stocking of 40 specifically identified lakes through the year 2000. The NPS initiated a research effort through Oregon State University in 1989 to determine the effects of fish stocking on naturally fish-free lakes. A final report on the initial phase of this research will be completed in 1994. Preliminary results of the research indicate that fish stocking may alter the invertebrate community structure as well as indigenous salamander populations. Human impacts upon fragile lakeshore environments also appear to be more pronounced where fish are stocked. Additional research will be conducted by Oregon State University during 1993-95 to provide greater insights regarding the impacts of fish stocking on salamander abundance and distribution. Research is necessary to establish the impacts of this historic practice and aid in developing aquatic resource mitigation and restoration plans.

Twenty-two species of amphibians inhabit forests of the northwest, with fourteen of these species endemic to the region. Many of the habitats that they are associated with are increasingly affected by human activities. Fish stocking, alteration of streams, wetlands, and riparian areas, and logging practices have created widespread impacts to amphibian communities. Amphibian population are declining at alarming rate. This may be caused by introduced species, decline in stratospheric ozone, air pollution, and other human generated factors. Several species of frogs have considerably contracted distributions as a result of human disturbances. The spotted frog, cascade frog, and red-legged frog all occur in NOCA and are listed by the State of Washington as threatened species.

Threatened and Endangered Species - Flora

There has been no survey of threatened and endangered plants in the Stephen Mather Wilderness. There are no known federally-listed threatened or endangered plant species, but there are three plants that are listed by the State of Washington as sensitive: Victorin's grape-fern, western ladies tresses, and giant helleborine. Included in the park's herbarium, which includes plants collected from nearby lands outside NPS boundaries, are fifty-seven species listed as threatened, endangered, or sensitive by the State of Washington. The Land and Resource Management Plan for the adjacent Mt. Baker-Snoqualamie National Forest identifies thirty-seven species of vascular plants that are listed as sensitive species, eighteen of which are in the park's herbarium and 18 of which are likely to be in the Wilderness.

Although sensitive species are not protected under the Endangered Species Act, NPS policy requires that they be managed to avoid a need for placing them on the federal list. Potential impacts on these species must be evaluated prior to a final decision on any specific, proposed project. The list of plant species will continue to change, as inventories produce more information on the occurrence, number, and distribution of species. Species may be removed from the list based on additional information or added to the list if they are discovered within the NPS boundaries. Conducting a field search and inventory of sensitive plants is a priority.

Table 4-3: Sensitive Plant Species Found in Mt. Baker-Snoqualamie National Forest

Species found in Mt. Baker-Snoqualamie N.F. and NOCA herbarium collection

Agoseris elata
Aster sibiricus var *meritus*
Botrychium lanceolatum
Botrychium lunaria
Botrychium montanum
Botrychium pinnatum
Carex buxbaumii
Carex pauciflora
Carex scirpoidea var *scirpoidea*
Carex stylosa
Coptis asplenifolia
Dodecatheon pulchellum var *watsonii*
Dryas drummondii
Gentiana glauca
Lycopodium dendroideum
Platanthera chorisiana
Ranunculus cooleya
Saxifraga debilis

Species found in Mt. Baker-Snoqualamie N.F. and possibly occurring in Mather Wilderness

Calamagrostis craggiumus
Campanula lasiocarpa
Carex comosa
Carex macrochaeta
Carex saxatilis
Castilleja cryptantha
Draba aurea
Fritillaria camschatcensis
Lobelia dortmanna
Loiseleuria procumbens
Luzula arcuata
Saxifraga cernua l.
Saxifraga integrifolia var *aretala*

Threatened and Endangered Species - Fauna

Endangered or threatened animals in the Stephen Mather Wilderness are the bald eagle, peregrine falcon, northern spotted owl, and grizzly bear. Candidate species for federal listing are the California wolverine, Pacific Western big-eared bat, Pacific fisher, North American lynx, cascade frog, spotted frog, northern goshawk, harlequin duck, and bull trout. Additional species that are not listed federally but are listed or being monitored by the state of Washington are the golden eagle, flammulated owl, common loon, vaux's swift, pileated woodpecker, and western gray squirrel. Table 4:4 summarizes the status and habitat of the Endangered, Threatened, and Sensitive Species found in the Stephen Mather Wilderness.

Exotic Species

Exotic animals have not been a problem with the exception of fish introduced into naturally fish-free waters or the introduction of non-native fish into waters with native fish. All the natural high lakes were devoid of fish life due to natural barriers to fish migration in their outlet streams. For over 50 years the Washington Department of Wildlife, U.S. Forest Service, and private sportsmen stocked over seventy-five high lakes in what is now the Stephen Mather Wilderness with rainbow trout, cutthroat trout, brook trout and golden trout. In 1989, a three year field research project was initiated to investigate the ecological impacts of stocked trout on naturally fishless lakes, especially the impact on amphibian populations which are declining at an alarming rate. Preliminary research results indicate that fish stocking alters the invertebrate community structure as well as indigenous salamander populations. Research to evaluate the aquatic ecology continues.

Some exotic plants have been introduced into the wilderness by livestock, however, little detailed information is available. Monitoring of three meadows began in 1993. The following eight species are of particular concern:

EXOTIC SPECIES

- Diffuse knapweed (*Centaurea diffusa*)
- Spotted knapweed (*C. maculosa*)
- Rush skeletonweed (*Chondrilla juncea*)
- St. John's-wort (*Hypericum perforatum*)
- Scot's-broom (*Cytisus scoparius*)
- Japanese knotweed (*Polygonum cuspidatum*)
- Foxglove (*Digitalis purpurea*)
- Common mullein (*Verbascum thapsus*)

Exotics are a major problem in disturbed low-elevation areas adjacent to the Wilderness including Hozomeen, the Stehekin Valley road and Highway 20 corridor. Researchers have documented 258 exotic plant species in, or near, the Wilderness. These comprise 17% of the total of over 1,500 vascular plant species known to the northern Cascade Range.

Table 4-4: Endangered, Threatened, and Sensitive Species

Species	Status		Habitat Needs/Occurrence
	US	WA	
Peregrine Falcon (<i>Falco peregrinus anatum and tundrius</i>)	FE	SE	Peregrine falcons normally nest on cliffs associated with water; they primarily hunt medium-sized birds. The Complex Wildlife Database includes 19 observation records of peregrine falcons from 1974 to present. Seventeen of the records are from the months July, August, and September and are probably associated with migrational movements. The closest known breeding occurs in the San Juan Islands, about 100 miles away.
Gray Wolf (<i>Canis lupus</i>)	FE	SE	Historically, wolves ranged throughout the state but were extirpated by the early 1900's. Reported sightings in the upper Skagit Valley increased over the last two decades. Three packs were documented in the North Cascades area in 1990. Pups and adults were seen or heard in the Complex near the Canadian border, and in the Okanogan and Wenatchee National Forests. Additional reports of individual wolves indicates a probable natural recolonization of wolves from Canada. Primary life requirements are forested and open habitats which support ungulate populations. In this area, deer are probably the primary prey species. Wolves are socially organized into packs, with pack territories ranging from 40 to 1,000 mi ² . Den sites and rendezvous sites, used for raising pups, are critical habitat components. Human-induced mortality is the major limiting factor affecting gray wolf survival. In the greater Cascades, adequate habitat requirements for a viable population may exist. There is currently no USFWS recovery plan for wolves in the Cascades.
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	FT	ST	There are no known records of bald eagles nesting in the Complex. However, just 2 km west of the Complex boundary, a pair of bald eagles have nested successfully for at least the past 5 years. Within the park and the Skagit River system, salmon provide an important source of food for many species of wildlife and a source of nutrients that contribute to the biological productivity of the system. Bald eagles return to the Skagit River in October. By mid-November, the Skagit River hosts the largest wintering population of bald eagles in the contiguous 48 states. Most of this eagle use is downriver from the Wilderness boundaries. Monitoring of the Complex wintering eagle populations over the past 10 years has shown this population to be stable or increasing.
Northern Spotted Owl (<i>Strix occidentalis caurina</i>)	FT	SE	The Complex has an estimated 110,000 hectares of potential spotted owl habitat. No systematic survey of this habitat has been attempted and the number of pairs of spotted owls utilizing park habitat is unknown. In Washington, 325+ pairs of spotted owls have been confirmed and the population is estimated to be approximately 600 pairs. The <i>Draft Recovery Plan for the Northern Spotted Owl</i> designates "Habitat Conservation Areas" (HCA's) to be managed and conserved for spotted owls. Six designated HCA's have all or parts of their areas within the Wilderness boundaries. Spotted owls prefer mature or old growth forests that are structurally complex — i.e., they contain trees of several species, sizes, and ages, contain standing and down dead trees, and have multistoried canopies. The nesting cycle begins in February or March, with eggs normally laid in early April. Fledglings are independent by mid-July and disperse in September or October. Pair home ranges are large. Foraging habitat is variable but generally in areas of at least 60% canopy closure, high structural diversity, and containing dominant trees of at least 24-inch diameter. Prey species are usually flying squirrels and woodrats. Roosting sites are often in cool, shady areas near streams, or in the lower canopy. Generally, owl habitat use is associated with riparian areas. Extensive spotted owl surveys of the Stehekin Valley in 1993 located four pairs near the Stehekin River, one along Lake Chelan and two additional pairs in the Agnes Creek DCA, just outside the Stephen Mather Wilderness.

Species	Status		Habitat Needs/Occurrence
	US	WA	
Grizzly Bear (<i>Ursus arctos</i>)	FT	SE	The Stephen Mather Wilderness is historic grizzly bear range; grizzlies were considered fairly common in the 1890's. Presently there is a small, resident, widely distributed, and reproducing population in the ecosystem. The estimated population is between 10 and 20 bears. The Stephen Mather Wilderness is in the center of the North Cascades grizzly bear ecosystem, which has been included as a recovery area in the USFWS <i>Grizzly Bear Recovery Plan</i> . It is the largest of the six ecosystems identified in the plan. Detailed food habits studies have not been made in the North Cascades. Grizzly bears are omnivores that eat a very wide range of plant and animal species, from grasses to large mammals. After hibernating for three to six months of the year, bears emerge from dens and generally move into low elevation riparian zones for the first spring plants, or into areas of large mammal winter range where carcasses may be found. In the summer bears move to subalpine and alpine areas and forage on green plants, roots, and small mammals. Before returning to the den, bears fatten on berries, other mast crops, or spawning fish if available. Home ranges are variable. In the Complex, introduced runs of anadromous fish in the spring, late summer, and fall could now provide a food source for grizzlies. Winter deer and goat ranges would also provide an early spring food source.
Bull Trout (<i>Salvelinus confluentus</i>)	PT	SG	The bull trout was common in the Stehekin River/Lake Chelan system in the early 1900's and also was native to the Baker River and Ross Lake drainage. The last confirmed report of bull trout in Lake Chelan was in 1957. The disappearance of bull trout has been mostly attributed to disease, probably introduced along with the many fish plantings. There have not been any recent comprehensive fishery surveys to confirm that the bull trout has been extirpated from the Complex. Optimal stream habitat for bull trout is characterized by clear, cold water; silt-free rocky substrate in riffle-run areas; well-vegetated stream banks; abundant instream cover; deep pools; relatively stable flow regime and stream banks; and productive fish and aquatic insect populations. Bull trout typically migrate from lakes in the fall, to spawn in clear streams with flat gradient, uniform flow, and uniform gravel or small cobble. Bull trout feed on a variety of aquatic macroinvertebrates and small fish.
California Wolverine (<i>Gulo gulo luteus</i>)	C2	SM	The wolverine is an uncommon year-round resident in high elevation, coniferous forest and subalpine areas. It is an opportunistic feeder eating a wide variety of small and mid-sized animals, and carrion. Wolverines are seldom seen however tracks have repeatedly been observed in winter, most commonly in the Bridge Creek drainage.
Pacific Western Big-Eared Bat (<i>Plecotus townsendii townsendii</i>)	C2	SC	Although bats are frequently observed in the Complex, it is unknown whether or not this particular species occurs here. Records exist for this species around the periphery of the Cascades, the closest being in the Mount Baker-Snoqualmie National Forest. The closest documented breeding occurs in western Whatcom County, about 85 miles distant. These bats hibernate in caves, and use caves, lava tubes, and abandoned buildings for breeding and roosting sites. Nursery colonies are extremely sensitive to human activity and readily abandon sites if disturbed. They are insect eaters and forage on the wing.
Pacific Fisher (<i>Martes pennanti</i>)	C2	SC	Prior to European settlement, fishers occurred throughout densely forested areas of the state. Fishers prefer dense forests with extensive, continuous canopies, complex forest floor structure, and are often associated with wetland forests and riparian areas. Riparian areas, lakeshores, and ridgelines are used as movement corridors. Fishers feed on red and flying squirrels, birds, porcupines, snowshoe hares, and carrion. Large hollow snags or logs are used for maternity dens. Home ranges vary from 0.6 to 15 mi ² . The North Cascades area around Stehekin has had the highest density of recent fisher records in the state, ten sightings between 1980 and 1991. Under natural forest conditions, the valley would be considered good fisher habitat, particularly the riparian zone. The trapping season for fisher has been closed in Washington since 1933.

Species	Status		Habitat Needs/Occurrence
	US	WA	
North American Lynx (<i>Felis lynx canadensis</i>)	C2	ST	A study in nearby Okanogan County found that lynx home ranges averaged 15 mi ² for females and 27 mi ² for males, and were the same for all seasons. Lynx density was a relatively low 6.7 per 100 mi ² . As in all of its range, the primary prey species was snowshoe hare, which were found in greatest densities in early successional lodgepole pine stands. It is likely that snowshoe hare numbers don't fluctuate in this area as they do at higher latitudes and thus do not influence lynx numbers. Unlike foraging habitat, den sites were located in mature forests (at least 250 years old) of Englemann spruce/subalpine fir/lodgepole pine at elevations over 4,900 feet. Kitten survival and recruitment into the population were low, possibly due to overall poor prey habitat in the study area. In Washington, lynx generally occur only above 4,500 feet. The population in the north-central Cascades is considered stable and is estimated at 126 animals. In the NRA's, lynx were occasionally trapped before trapping ended in 1986.
Cascades Frog (<i>Rana cascadae</i>)	C2	--	The Cascades frog prefers quiet, sometimes temporary ponds for breeding, which begins as soon as ice is off the water. Eggs are deposited in shallow water near shoreline. The time required for development, from egg through metamorphosis, varies between 40 and 60 days depending on water temperature. Food habits are not well known. They feed on aquatic insects, as well as terrestrial insects within close proximity of water. They can be active from February to October, and hibernate in mud over the winter. Cascade Frogs have been found in several locations in the Complex in recent years.
Spotted Frog (<i>Rana pretiosa</i>)	C2	SC	The spotted frog prefers marshy edges of ponds or algae-grown overflow pools of streams. Tadpoles may overwinter as larvae and metamorphose the following spring. Adults are opportunistic feeders taking a broad range of insect prey. One specimen was observed in the Complex in 1991.
Northern Goshawk (<i>Accipiter gentilis</i>)	C2	SC	There is little research on goshawk ecology specific to Washington. Generally, goshawks nest in trees in mature or old growth coniferous forests. They are nonmigratory, though may move to subalpine areas in late summer/fall. The nesting period occurs between mid-April and September. Hunting generally occurs under the forest canopy for ground-dwelling birds, ducks, and mammals as large as hares. Primary limiting factors are loss of habitat through logging, reproductive failure, and human disturbance. There is one known active nest in Lake Chelan NRA.
Harlequin Duck (<i>Histrionicus histrionicus</i>)	C2	SG	Nesting pairs prefer forested mountain streams with fast-flowing water. Nests are usually adjacent to the river, but can be up to 90 feet from the water. Renesting does not occur after human disturbance. Diet consists primarily of aquatic invertebrates such as caddisfly larvae, which are captured underwater. After wintering on the coast, harlequins use the Stehekin River from April through September. Seven to eleven breeding pairs were observed in 1990, 1991, and 1993 on the Stehekin River between High Bridge and Lake Chelan. Birds were most often observed in areas of river channel meander, which had a cobbled bed and forested banks.
Golden Eagle (<i>Aquila chrysaetos</i>)	--	SC	There are only 80 breeding pairs in the state. Usually nest on cliffs, but sometimes in large trees. They hunt primarily mid-sized mammals — probably snowshoe hares, marmots, and ground squirrels in this area. They nest in high subalpine/alpine communities. A few golden eagles are observed within the Complex each year. Most of these observations are recorded during fall migration. Only one nest has been confirmed and was found along the western border of the Complex. No systematic surveys have been conducted to assess the status of this species within the Complex.
Flammulated Owl (<i>Otus flammeolus</i>)	--	SC	This owl is a cavity nester usually in mature to old, ponderosa pine communities with multi-layered canopies. A recent Idaho study also found breeding in stands dominated by mature Douglas fir. This owl is migratory, spending only the breeding season in Washington from April to October. It can nest in loose colonies. Nests are in snags or live trees of at least 12-inch diameter, often near forest openings. Home ranges in Oregon averaged 25 acres. It hunts primarily for moths and grasshoppers, but normally does not hunt or call before total darkness. No records from the Wilderness but possibly occurs there based on available habitat. Has been documented 60 miles to the south.

Species	Status		Habitat Needs/Occurrence
	US	WA	
Common Loon (<i>Gavia immer</i>)	--	SC	The loon is a fish-eating diver that is regularly found on Lake Chelan in the winter, during its migration, or rarely in summer. Most loons winter along the Pacific Coast. In winter, individuals maintain feeding territories during the day, and gather in groups at night. It is possible that loons nested at the head of the lake before the dam caused severe water fluctuations. In May, 1988 a pair of common loons were confirmed nesting at Hozomeen Lake. Nesting has occurred in all years since 1988. This pair was one of only 6 nesting records confirmed for Washington in 1990. The Complex Wildlife Database records show a pair of common loons have been observed on Hozomeen Lake nearly every year since 1971. A few observations are reported each year from nearly all the major lakes and reservoirs within the Complex.
Vaux's Swift (<i>Chaetura vauxi</i>)	--	SC	This species is reported annually on park Breeding Bird Surveys and is believed to breed within the Complex boundaries, though no conformation of breeding exists in park records. U.S. Forest Service research has found Vaux's swifts to be closely associated with unmanaged old-growth Douglas-fir forests of the Pacific Northwest. Vaux's swifts are commonly seen flying above this habitat type within park boundaries. They usually nest in a snag cavity; they prefer mature and old growth Douglas fir and hemlock forests. Nest snags are often hollow and charred by fire. In a northeast Oregon study, swifts nested in grand fir cavities excavated by pileated woodpeckers. Swifts have been occasionally observed nesting in chimneys or on cliffs, and they communally roost in broken-top, hollow trees. They forage on the wing for flying insects. They are migratory, and are only in the region from April to September.
Pileated Woodpecker (<i>Dryocopus pileatus</i>)	--	SC	The pileated woodpecker is a large, conspicuous woodpecker that prefers Douglas fir, ponderosa pine, or deciduous riparian forests with two or more canopy layers. They nest in snags or live hollow trees with an average diameter of 27 inches and height of 87 feet. Numerous tree species are chosen. A new cavity is excavated each year. The woodpecker roosts year-round in old nest cavities. Old cavities are also used by flammulated, saw-whet and screech owls, Vaux's swifts, flickers, chickadees, bluebirds, flying and tree squirrels, woodrats, and bats. Pileated woodpeckers establish large, year-round territories. Oregon territories ranged from 500 to 3,600 acres. They forage for insects, primarily carpenter ants, on dead and dying trees as well as on downed logs and stumps. Snags are relatively more important in winter when downed material is covered with snow. No assessment of the status of this species has been conducted in the Complex although it is likely that at least two pairs use and nest in the Stehekin valley.
Western Gray Squirrel (<i>Sciurus griseus</i>)	--	ST	Food habits studies have not been conducted in Washington. Other studies indicate that primary foods are truffles (hypogeous fungi), acorns, and pine nuts. Maple and fir seeds are likely used here as additional mast food items. Nests are constructed of sticks in either a tree crotch, or in a cavity in an old live or dead tree. Recorded home ranges vary from 0.75 to 16 acres. Western gray squirrels are occasionally observed in the Stehekin Valley. The North Cascades Wildlife Database list 11 records for the Stehekin Valley. The status of this squirrel population is unknown. The database has one unconfirmed record of a gray squirrel at Willow Lake, Ross Lake National Recreation Area.
Victorin's Grape-Fern (<i>Botrychium minganense</i>)	--	SS	This is a fern-like plant of moist areas. It is found in two undisturbed sites in the Stehekin valley.
Western Ladies-Tresses (<i>Spiranthes romanzoffiana</i> var. <i>porrifolia</i>)	--	SS	This is an orchid of moist to wet areas that blooms in July and August. It is found in one disturbed site in Lake Chelan NRA.
Giant Helleborine (<i>Epipactis gigantea</i>)	--	SS	This is a nonshowy orchid that prefers streambanks, seeps, and lake margins. It is found on undisturbed sites in Lake Chelan NRA.

Abbreviations of Status of Endangered, Threatened, and Sensitive Species used on Table 7.

FE = Federally Endangered. Listed by the U.S. Fish and Wildlife Service as a species that is in danger of extinction throughout all or a significant portion of its range.

FT = Federally Threatened. Listed by the U.S. Fish and Wildlife Service as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

FC = Candidate. Species that are under consideration for listing by the U.S. Fish and Wildlife Service as threatened or endangered for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.

PT = Proposed. Candidate species that the U.S. Fish and Wildlife Service has determined are warranted for listing as a threatened or endangered species but for which rules have not yet been promulgated.

SE = Washington State Endangered. Listed by the Washington Department of Fish and Wildlife as a species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.

ST = Washington State Threatened. Listed by the Washington Department of Fish and Wildlife as a species native to the state of Washington that is likely to become an endangered species throughout all or a significant portion of its range within the state without cooperative management or removal of threats.

SS = Washington State Sensitive. Listed by the Washington Department of Fish and Wildlife as a species native to the state of Washington that is vulnerable or declining and is likely to become threatened or endangered in a significant portion of its range within the state without cooperative management or removal of threats.

SC = Washington State Candidate. Under consideration for possible listing as endangered, threatened, or sensitive.

SM = Washington State Monitor. Designated by the Washington Department of Fish and Wildlife as a species native to the state of Washington that is of special interest because (1) it at one time was classified as endangered, threatened, or sensitive, (2) it requires habitat that has limited availability during some portion of its life cycle, (3) it is an indicator of environmental quality, (4) further field investigations are required to determine population status, (5) there are unresolved taxonomic problems that may bear on its status classification, (6) it may be competing with and affecting other species of concern, or (7) it has significant popular appeal.

SG = Washington State Game Species. Any species of wildlife or fish for which seasons and bag limits have been established by the Washington Department of Fish and Wildlife.

Natural Fire Regime

Fire plays a critical role in development and maintenance of the ecosystem. Prior to the establishment of the Complex, these lands were managed under the United States Forest Service, under a fire policy of total fire suppression. This policy continued under the National Park Service management until the late 70's, when it was recognized that fire performed an important natural role in the ecosystem.

Past and current suppression may alter the fire regime and cause hazardous accumulations of fuel that could lead to unwanted, potentially catastrophic, wildfire occurrence, and unnatural changes in forest stand composition and wildlife habitat. In addition, suppression techniques can cause resource damage by killing vegetation, causing erosion, and impacting aesthetic values. In the Stehekin Valley, where fires were suppressed for a hundred years, hazardous accumulations of fuel have been identified as a problem.

The Park's Wildland Fire Plan, approved in 1991, designates the Wilderness as a Prescribed Natural Fire Zone where lightning fires are managed as prescribed natural fires if they meet required conditions. Representatives from the Complex, U.S. Forest Service, and British Columbia Parks coordinate fire management across agency boundaries.

Archeological Sites

Archeological surveys have revealed widespread evidence of Native American use of the lands in North Cascades National Park Complex over the last 8,000 years. To date, 206 prehistoric archeological sites have been inventoried in the Complex. They include lithic scatters; stone quarries and collecting areas; hunting, gathering, fishing, and food processing camps; rockshelters, overhangs, and caves; rock features including talus pits, rock walls and alignments, and rock cairns; pictographs and petroglyphs, permanent and semi-permanent villages and camps; and prehistoric trails. As a group, these sites reveal that the mountains of the North Cascades were used by Native Americans much more than earlier researchers believed.

Only about 5% of the Complex has been surveyed, little of it within the Wilderness. About 30 archeological sites have been identified in the Wilderness. The Park's archeological overview and assessment predicts that many hundreds of prehistoric sites exist within the Park boundaries including sites in subalpine and alpine zones.

Presently, an unknown number of important archeological sites are in need of management actions in order to preserve, conserve, or maintain site integrity and the values that contribute to their National Register significance. Factors that adversely affect site integrity include flooding and erosion, recreational activity, unauthorized public visitation of sites, casual artifact collection, wild fires, maintenance, on-going park operations, as well as gradual deterioration through benign neglect. Such agents destroy site integrity as defined by the National Register criteria and hinder the NPS from meeting its National Historic Preservation Act, Sec. 106 mandate to take into account the effects of ground-disturbing activities on its lands. There are a number of backcountry campsites, trails, climbing routes, and other recreational use areas that are in the vicinity of known prehistoric lithic scatters.

Historic archeological sites presently identified within the Complex are associated with 19th and early 20th century settlement and mining. Aside from the 1984 Historic Structures Inventory, which identified several sites for further evaluation, no systematic survey of historic archeological sites within the park has been undertaken.

Historic Structures

The historical research program for the Complex was initiated in 1970. A Historic Basic Data Study, prepared by Erwin Thomson, provides an overview of some of the historic themes and known resources associated within the area. A List of Classified Structures (LCS) was compiled in 1976. In 1984, a Historic Structures Inventory of all structures forty years or older within the park's boundaries was prepared. A Historic Resource Study, completed in 1986, identifies the Park's historic themes as exploration, settlement, commercial development, recreation, and administration of the area by the United States Forest Service. The following historic structures are located within wilderness and potential wilderness:

HISTORIC STRUCTURES

Copper Ridge Lookout (1228)
Perry Creek Shelter (1208)
Beaver Pass Shelter (1209)
Sourdough Lookout (1226)
International Boundary
Desolation Peak Lookout (1227)
Deer Lick Cabin (1219)
Devil's Corner Suspension Bridge
Gilbert's Cabin (1024)
Meadow Cabin (1217 & 1218)
Skagit Queen Mine Power Plant
Rock Cabin (1216)
Rowse Sawmill
Black Warrior Mine (22)
Bridge Creek Ranger Station (84)
Bridge Creek Sawmill
Bridge Creek Shelter
Sulphide Cabin/Frisco Cabin
Flick Creek Shelter

On-going stabilization is occurring at the three lookouts, Bridge Creek Ranger Station, and Meadow Cabin.

Heritage Values

Native Americans

At least four different Native American groups are known to have used the area:

- Upper Skagit, who utilized the resources of the Skagit River drainage generally up to the gorge at Newhalem, but occasionally to points further upstream.
- Chilliwack, for whom there is evidence that they used the upper reach of the Chilliwack River.
- Lower Thompson, who are known to have used the resources of the upper reaches of the Skagit River into the area now covered by Ross Lake.
- Chelan, who utilized the resources of the Stehekin River drainage and Lake Chelan.
- In addition, the Methow-Okanogan may have used resources within the present area of the Complex.

There is a need to establish an ethnography program that will identify and inventory:

- Historic and contemporary human populations (park-associated groups), including relationships/affiliations with prehistoric populations.
- Historic and contemporary subsistence uses and residency.
- Current uses of ceremonial or religious localities by indigenous peoples.
- Traditional sacred localities and/or objects by indigenous peoples.
- Ethnogeographic resources (place names used by various cultural groups).
- Traditional Cultural Properties (ethnographic resources narrowly defined with reference to the National Register of Historic Places, see National Register Bulletin 38).

Consultations with local populations who reside in and near the Complex have taken place in recent years and have revealed information about park resources that would be otherwise unavailable. The RMP identifies the need to develop and implement a *Consultation Plan* to ensure that members of tribes who once lived inside the current park are consulted with on a regular and on-going basis.

Solitude

Section 2 of the Wilderness Act of 1964 partially defines wilderness as an area having outstanding opportunities for solitude. In the Stephen Mather Wilderness, opportunities for solitude are greatest in the more remote crosscountry zones; they are less available in areas accessible to day users. Overnight recreational use is closely managed to provide a high level of solitude, with management actions including permits, designated campsites, and party size limits. Day use has not been as closely managed. Areas such as Cascade Pass, Mt. Shuksan, Thornton Lakes, Easy Pass, and Hidden Lake Peaks receive heavy day use, although exact numbers are not known. Options to monitor and manage day use need to be addressed in any future revision to the Wilderness Management Plan.

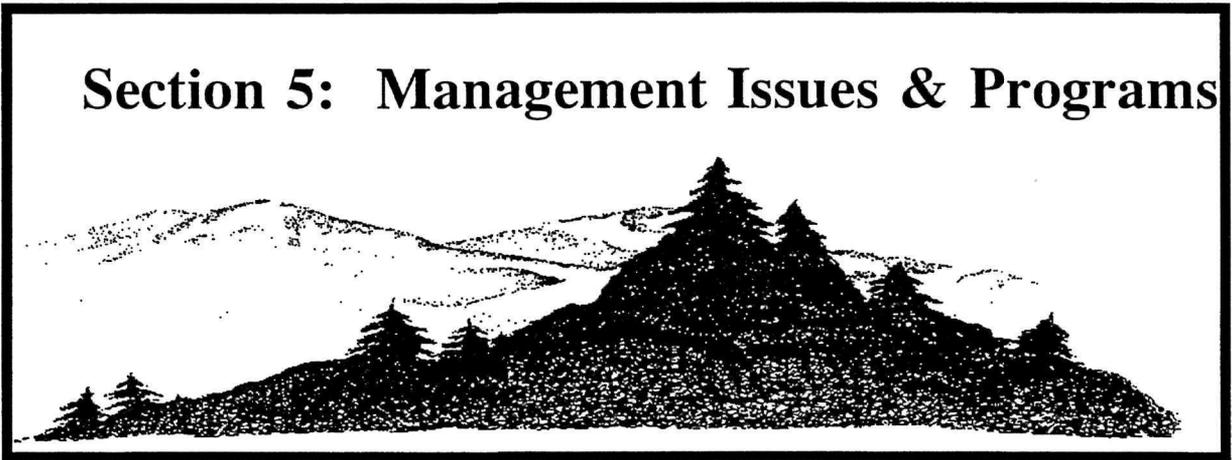
Primitive Recreation Opportunities

The Recreational Opportunity Spectrum concept classifies natural environments from the "paved to the primeval" with wilderness as the least modified extreme. Under this classification scheme, the North Cascades National Park Service Complex and adjacent lands provide a fairly broad range of recreational opportunities. These opportunities include national park wilderness, national recreation area wilderness, national recreation area non-wilderness, national forest wilderness, national forest non-wilderness, wild and scenic rivers, state parks, state forest lands, provincial park, provincial recreation lands, and private timber lands.

The range of recreational opportunities in the greater North Cascades is also relatively broad in the narrow wilderness category. Five national forest wilderness areas are contiguous to the Stephen Mather Wilderness (Glacier Peak, Lake Chelan-Sawtooth, Mt. Baker, Noisy Diobsud, and Pasayten). Another three wilderness areas (Alpine Lakes, Boulder River, and Henry M. Jackson), are within a few hours drive.

Together, these nine wilderness areas comprise almost 2.5 million acres. Each wilderness provides somewhat different recreational opportunities, as influenced by managing agency mandates, enabling legislation, purpose, management actions as related to goals and objectives, size, features, accessibility, and other factors. The Stephen Mather Wilderness is possibly at one extreme of wilderness recreational opportunities in the greater North Cascades, with the greatest solitude and most pristine conditions, but the strictest regulatory control.

Section 5: Management Issues & Programs



1. Search & Rescue Operations

North Cascades averages between twenty-five and forty reported search and rescue in an average year. In 1993 there were thirty-three searches and/or rescues costing \$8,222. One person died from a heart attack, and one person was seriously injured with a fractured femur. The remainder of the incidents were either non life-threatening injuries, or non injury. Most injuries were to lower extremities and occurred while climbers were crossing non-technical terrain. Eighteen of the incidents resulted from the failure of climbing parties to notify the Ranger Station upon completion of their trips.

The Chief Ranger and Wilderness District Ranger participated on a national taskforce to evaluate the possibility of recovering rescue costs. Denali and Mount Rainier National Parks will be taking the lead in charging a climbing user fee to help recover the cost of managing high altitude base camps, human waste disposal and rescue costs. No fee is being considered for the North Cascades because of the wide dispersal of climbing routes and the large number of access routes spread over three Counties and British Columbia.

The park encourages safety to climbers and backcountry users through a "climbing safety program." Components of this program include an annual newsletter, poster, displays at the Wilderness Information Center, and patrols with specific safety education objectives.

2. Visitor and Resource Protection Issues

Unauthorized commercial guiding, larcenies from vehicles at trailheads, commercial mushroom harvesting and hunting violations have been the most significant visitor and protection issues of recent years.

A handful of businesses are suspected of non-licensed commercial guiding in the Wilderness. In the Juanita Lake/Triplet Lakes area, this activity is causing notable resource damage. This problem is being addressed through direct contact with the outfitters, patrols, and law enforcement investigations.

In 1992 there were forty-seven larcenies from vehicles parked at trailheads. In 1993 there was only one reported larceny from a trailhead. In 1994 larcenies are again a problem. Visitors are warned of the activity at the time of permit issuance, and the park is cooperating with local authorities in investigations.

Hunting is allowed in the National Recreation Area portions of the Wilderness, and ranger patrols monitor this activity. Over the past five years these patrols have been successful in dramatically decreasing the frequency of violations and resource damage associated with this activity. Illegal hunting in the national park portion of the Wilderness is known to occur, but probably not at a high level. One poaching incident was successfully investigated in 1993.

In 1993, eight percent of the groups contacted by rangers in the Wilderness were observed violating one or more park regulations. A total of 232 violations were observed and corrected. The more common types of violations observed were no permit, pets, resource damage, camping, improper food storage, vandalism, littering, campfires, party size, and bicycles.

The use of bicycles and other wheeled vehicles (such as wheel barrows) seems to be increasing, especially on the Bridge Creek and Cascade Pass corridors, and along the Chilliwack Trail. Education and patrols are attempting to reverse this trend.

The high prices paid for wild mushrooms by commercial buyers is causing resource damage on public lands throughout the Pacific Northwest. There have been two homicides of commercial mushroom pickers in Washington and Oregon in the past three years. Large numbers of pickers are denuding some areas, trampling soils, and displacing recreational users. From 1991 - 1993, there were twenty-five contacts with commercial mushroom harvesters; nine citations were issued. The 1994 Compendium was changed to prohibit the collection of mushrooms from the entire Complex.

3. Law Enforcement and Protection

For the past decade the Park has practiced a protection strategy of basing five wilderness rangers at sensitive subalpine areas along major travel corridors. These areas are Copper Ridge, Whatcom Pass, Cascade Pass, Twisp/McAlester Passes, and Juanita Lake. Rangers conduct ten day patrols, and are based at camps in their areas of responsibility.

The Park has found this system to have a number of strong points. First, hazards and conditions are closely monitored throughout the season and are easily communicated to the public. Second, when visitors meet rangers in the backcountry, they get detailed and specific information from persons intimate with the area. Third, accountability is high, as important jobs aren't left for the next ranger (as can happen with roving patrols). Finally, the Park's long-term and considerable investment in the restoration of these subalpine areas is protected.

Wilderness District staff conducted 128 patrols during 1993. Patrol length ranged from one to ten days. Rangers hiked 1,470 miles, and logged 3,561 patrol hours. The Copper Ridge, Twisp/McAlester Passes, and Juanita Lake positions were not funded in 1993. Consequently, the District was forced to revert to the roving ranger strategy of the 1970's. Thirty-two of the 37 trail segments (86%), and 32 of the 65 crosscountry zones (49%), were patrolled at least once. Five trail segments (14%), and 33 crosscountry zones (51%), were not patrolled. Rangers spent 921 patrol hours (26%) in crosscountry zones, and 2,640 hours (74%) on trail segments. Rangers documented patrols by "patrol units". Each patrol unit was defined as that portion of a day spent on an individual trail segment, or in a specific crosscountry zone. Patrol units ranged in length from one to eight hours. Rangers accumulated 568 patrol units.

The park has found a basic staffing need to be two climbing rangers and two short-trails rangers. The climbing rangers patrol crosscountry zones and popular climbing areas. The short-trails rangers conduct one-to-five day patrols of heavily used day-use destinations and trailed areas not covered by area rangers.

The District began annual High Hunt deer season patrols of Lake Chelan NRA's backcountry in about 1990. Violations were common the first year, but have decreased steadily since. Patrols during the 1993 season observed no significant violations. Hunter activity has also decreased. Hunters who continue to use the area have told rangers that a number of groups have moved to Forest Service lands, rather than change behavior. In 1993, camping permits were issued to seven High Hunt parties. Two of these parties included stock.

4. Permit System

Since 1973, North Cascades National Park Service Complex has required all overnight backcountry travellers to obtain camping permits. Since 1990, the Wilderness District has managed permit issuance and site availability with the help of BCRES, a software program written specifically for the District. Annually, 4,000-5,000 permits are issued from twelve locations. See Table 5-1 for 1993 statistics.

The purposes of the permit system include the:

- Controlling of recreational impacts.
- Providing for a wilderness experience that provides level of solitude meeting the objectives of the Wilderness Management Plan.
- Managing of climbing risks by controlling the level of use on popular routes.
- Opportunity for communicating with wilderness users about safety, minimum impact, and wilderness values, through in-person issuance of permits.

Issuing Stations

Wilderness camping permits are available at eleven locations staffed by the NPS and USFS. They are also issued by ranger in the field. Table 5-1 provides a breakdown of where permits are written.

Table 5-1: Issuing Stations for North Cascades Backcountry Permits

ISSUING STATIONS	AGENCY	PERMITS ISSUED, 1993	
		Percent	Number
Wilderness District Information Center	NPS	54%	2,264
Stehekin (Visitor Center & Ranger Station)	NPS	15%	612
Glacier Public Service Center	USFS, NPS	8%	338
Self-Issued (all stations)	N/A	5%	220
Field-Issued by Rangers	NPS	4%	176
Winthrop/Early Winters Ranger Station	USFS	4%	168
Hozomeen Ranger Station	NPS	2%	102
Colonial Ranger Station	NPS	2%	74
Sedro-Woolley Headquarters	USFS, NPS	2%	97
Newhalem - Visitor Center & Ranger Station	NPS	2%	96
Twisp Ranger Station	USFS	1%	46
Chelan Ranger Station	USFS	1%	34
Darrington Ranger Station	USFS	0%	00
TOTAL			4,207

The permit system functioned well in 1993. The system is accepted by the public and there were no formal complaints.

Permit Compliance

In 1973, the year the permit requirement was implemented, compliance was about 65% and all but 2% of the visitors accepted the concept of a permit system. Compliance rose to 86 percent in 1974. Ranger patrol report data found that 92 percent of the groups contacted in the field (2,098 of 2,188 groups) in 1993 were permitted.

The summit registers of four peaks were compared with the permit data for 1992 and 1993. Permit compliance for persons completing the summit registers is shown in Table 16.2.

Table 5-2: Permit Compliance Compared with Four Summit Registers, 1992 & 1993

PEAK	NUMBER OF PARTIES LISTED ON SUMMIT REGISTER	# OF SUMMIT REGISTER PARTIES PERMITTED	% OF SUMMIT REGISTER PARTIES PERMITTED
Goode	13	7	54%
Logan	20	9	45%
Redoubt	38	9	26%
Spickard	38	9	26%
Total	104	34	31%

The apparent low rate of permit compliance for groups signing the summit registers may be due to any of a number of factors. Ranger patrols spent 74% of time on trails: perhaps hikers more frequently obtain permits than climbers. Permits are not available in British Columbia, the beginning of a popular approach to both Redoubt and Spickard. In some instances the actual permittee may not have signed the summit register.

Reservations

A limited backcountry campsite reservation system was installed in 1990 on a trial basis. The reservation system takes a major commitment of staff time and the success rate, the number of requests that actually mature to permits, is only 38%. Ninety percent of reservation requests were from private citizens. Commercial use licensees accounted for 3%, Boy Scouts accounted for 4% (mostly for canoe trips on non-Wilderness Ross Lake), and other organized groups generated the remaining 3%. After making a detailed analysis of the reservation system in 1993, it was decided to eliminate advance reservations begging in the 1995 season. Information about the elimination of reservations is being disseminated in 1994 to give users the opportunity to plan for future trips.

5. Mining & Minerals Management

There is no active mining and no pending "Plans of Operation" within the Stephen Mather Wilderness. There are seven patented and no unpatented mining claims. There are no active oil and gas operations in or near the Complex. There are at least twenty-one Abandoned Mine Land (AML) properties; it is unknown how many are in need of restoration. There was no provision in the Washington Wilderness

Act to allow new mining in the Stephen Mather Wilderness. Mineral rights and access to the patented mining claims is a potential threat to wilderness integrity.

The owner of the 125 acre Dorothy claim and mill site has expressed interest in selling the property to the NPS. It has been appraised but there is a vast difference between appraised value and asking price. The owner, who does not have an approved plan of operations, requested permission to drive a vehicle over the Thunder Creek trail to access the site. Permission was denied although he was advised that the site could be accessed by horse, foot or by landing a helicopter on private land.

6. Range Management

The only grazing permitted in the Stephen Mather Wilderness is the grazing of recreational stock within Lake Chelan and Ross Lake NRA's. The effects of large-scale commercial sheep grazing from the pre-park era remain visible in many areas. Terracing and modifications to the original plant community are apparent in Little Jack Mountain, Lake Juanita, and other sub-alpine meadows.

The level of recreational grazing has not been well documented, but is generally light. In 1993 the park studied the effects of such grazing at several stock camps in the Lake Chelan National Recreation Area portion of the Wilderness, and determined the impact that year to be too slight to measure.

In 1994 the Wilderness District initiated procedures to fully implement an already existing park regulation requiring grazing permits for all recreational grazing. The data generated will hopefully improve the park's knowledge of grazing activity.

7. Land Ownership

All of the private land in the Wilderness is in the form of patented mining claims. There are no other non-Federal lands in the park. The Land Protection Plan (LPP) (updated January 1990) recommends fee acquisition of all private land in the National Park.

The current list of non-federal land in designated and proposed wilderness including their priority for protection is in Table 5-3.

Table 5-3: Inholdings within Stephen Mather Wilderness boundaries

Tract	Owner	Acres	Proposed Estate	Priority
02-102*	Webster	4.98	Fee	1
02-103**	Webster	121.78	Fee	1
04-101	Courtney	20.66	Fee	1
05-105	Johnson	19.07	Fee	2
05-106	Johnson	5.00	Fee	2
05-111	Behrens	20.66	Fee	2
02-101	Clagstone	34.00	Fee	3
07-106	Blackburn	5.16	Min	3
		231.31		

* Mill site only

** Mineral right only. No development other than that associated with mineral development would be possible.

8. Problem Wildlife

Bears

No one has been injured by a bear in the Stephen Mather Wilderness in the past ten years. The Wilderness averages less than one reported bear-human conflict per year. There were no human/bear conflict incidents reported in the wilderness in 1993. The Hannegan Pass SCA Ranger reported three bears were harvested from Forest Service land in the Hannegan Pass area. In one of these instances, the Ranger observed a hunter shoot the bear. The wounded animal rolled down a slope and several yards into the park, where it was killed by the hunter.

The Hannegan Pass area has a history of bear incidents, and for that reason was closed to camping by the Forest Service in 1991. In August, 1993 the Wilderness District Ranger hiked to the Pass with a group of Forest Service wilderness managers and biologists. At this meeting the group decided to implement food storage options, install bear poles, and to re-open the area to camping. The Wilderness District Ranger agreed to develop a bear pole design for common use by the Mt. Baker - Snoqualmie National Forest and North Cascades NP.

Bear-human conflicts are primarily managed through education and food storage requirements. Education occurs at contact stations, trailhead bulletin boards, literature, and ranger patrols. Wilderness Center staff provided bear avoidance and food storage recommendations to all backcountry camping permittees and wilderness rangers discussed these topics with hikers. In 1993, ranger patrols observed that about 86% of wilderness users practiced proper food storage. Approximately ten camps have bear poles or cables. Most of these are in need or replacement. They are in poor condition or are damaging trees by girdling trunks. Most visitors properly store food by hanging it from tree branches. In some areas, such activity is damaging vegetation and causing social trails. The park is

currently evaluating food storage options and in encouraging the use of bear-resistant food storage canisters. Jack Mountain Camp is being upgraded to meet grizzly bear standards with a SEEC grant.

A revision of the Bear Management Plan is needed. This plan needs to address grizzly bears, set wilderness campsite design standards and adopt a minimum-tool food storage standard for wilderness camps.

Cougar

There was one cougar-human incident in the Wilderness in 1993. In October, a cougar stalked a party of four hikers on the Copper Ridge trail. The group had illegally taken in a retriever which was struck in the muzzle by the cougar before being driven off by the party. A cougar killed a housecat at a Seattle City Light employee residence in Newhalem within the Park Complex. In January, a one year old male cougar was shot and killed by a Stehekin resident after it entered a backyard and badly injured a dog. The park produced a new handout "Ghost Cat of the Cascades" to educate visitors about the natural history of the mountain lion and safety in cougar country.

9. Aircraft overflights

Frequent overflights occur within the Complex from commercial, private, and military aircraft. Adverse impacts include noise, impairment of visitor enjoyment, wildlife disturbance, safety problems and cultural resource degradation. In 1993, Wilderness Ranger District staff recorded all aircraft engine noise heard, both number and duration. Ranger patrols heard 1,031 overflights. This averaged one aircraft heard for every 3.5 hours of patrol. Aircraft engine noise was audible for 17 seconds out of every hour. The average time that an overflight was observed was 0.95 minutes. Most aircraft were above 500 ft. agl.

The Federal Aviation Administration has issued a Notice to Airmen that a minimum altitude of 2,000 feet above the terrain over wilderness and National Parks be voluntarily observed by all pilots. The park has requested that the boundary be on aeronautical maps produced by the National Aeronautics and Space Administration. The National Park Service is presently studying the effects of aircraft noise on visitors in selected national parks and wildernesses.

Commercial and recreational sight-seeing flights cause considerable aesthetic impacts to the rugged wilderness of the central portion of the park. Most of the flights occur along the rugged peaks of the Cascade Crest, the central area of mountaineering and climbing in the North Cascades. Rarely are planes above the 2000' FAA advisory level. Most commonly, the aircraft fly below the highest peaks and often only a few hundred feet above the glaciers and climbing routes along the crest. Each year, the NPS receives numerous complaints from climbers regarding flights.

Military jets occasionally make low-level flights over the Wilderness and are sometimes seen using the narrow valleys and passes for what appears to be low level training flights. Often these military planes fly in pairs. Noise levels during their passes are extreme. This occurs approximately five to six times each summer season. Small plane pilots, sharing the same airspace, repeatedly express concern regarding the safety of these high-speed aircraft. High-speed, low elevation jet flights are dangerous to livestock parties; horses have been spooked in hazardous terrain and horses and riders have been endangered. When the exact time, location, and a good description of the aircraft are immediately reported to the FAA representative at Whidby NAS, he has followed through on taking effective action against pilots to ensure that there is no repetition.

Overflights are expected to increase. There is a need to further document and study the noise impact to visitors and wildlife in the Wilderness especially at Cascade Pass.

Section 6: Recreation Use



Overnight Wilderness Use

The Stephen Mather Wilderness offers an opportunity for solitude and a quality backcountry experience in one of the wildest and least visited mountain ranges of the United States. Total 1993 backcountry overnight use for all of NOCA was 31,655 visitor nights. The Wilderness accounted for 77 percent of this visitation, or 24,384 visitor nights. The most popular activities are:

1. Day-Use Hiking
2. Backpacking
3. Mountaineering.
4. Horseback/Pack Stock Use
5. River-Running/Boating
6. Rock Climbing

Table 6-1: Annual Visitation Statistics for the Stephen Mather Wilderness.*

YEAR	VISITOR NIGHTS	PARTY SIZE	LENGTH OF STAY
1993	24,384	3.33	3.42
1992	23,786	3.05	3.47
1991	24,592	3.05	3.53
1990	12,078	Not available	Not available
1989	17,341	Not available	Not available
1988	14,014	Not available	Not available

* These numbers do not include overnight backcountry use for the non-wilderness areas of Ross and Diablo Lakes, and Stehekin.

Day Use

The Park doesn't have reliable data concerning levels of day use. The best estimate - although poorly supported by data and unchanged for the past 10 years - is 20,000-25,000 visits annually. The heaviest day use area is Cascade Pass. Relatively heavy day climbing use seems to occur on Mt. Shuksan, primarily from groups camping at the Forest Service's Lake Anne. Other known popular day use areas include Hidden Lake, Monogram Lake, Thornton Lake, and Easy Pass. With the exception of Cascade Pass, none of these areas receive regular patrol coverage.

Use Levels

Table 6-2 provides further perspective on the level of backcountry use for North Cascades National Park Service Complex.

Table 6-2: Backcountry Use Levels

TYPE OF BACKCOUNTRY USE	ACTUAL USE (Visitor nights)		THEORETICAL CAPACITY, 1992 AND 1993 (Visitor nights)	USE LEVEL	
	1992	1993		1992	1993
Boat camps, Ross and Diablo Lakes (non-wilderness)	8,482	7,271	25,400	33%	29%
Wilderness hiker camps	16,098	21,394	77,400	21%	28%
Wilderness stock camps	1,257	380	19,400	6%	2%
Crosscountry zones	5,383	2,610	242,400	2%	1%
All Backcountry	31,220	31,655	391,257	8%	8%

For the purpose of this discussion, theoretical capacity is defined as the maximum number of backcountry users that could be accommodated in the Wilderness, if every tent pad was occupied and every crosscountry zone quota was filled on every available night. As the overwhelming majority of backcountry use occurs in the summer, a conservative estimate of the total number of nights available each year is 100. For the above calculations, tent pads were considered to accommodate two persons each.

The backcountry is most heavily visited in August. In 1993, 37% of annual use occurred in August. July was the second busiest month with 27% of use and September was the third busiest with 19% of use. Only 1% of 1993's use occurred in the six month period between November and April.

Origin of Visitors

A 1974 study found that residents of Washington accounted for 74% - 78% of all visitors to the Park. In 1993, the origin of visitors was similar: 79% of all persons obtaining permits indicated they were from the state of Washington. The 1993 data also revealed that 52% of persons obtaining permits were from the greater Seattle area, and 67% were from the greater Puget Sound area (Seattle, Whatcom County, and Skagit County). See table 6-3 for additional analysis of visitor origins.

Table 6-3: Origin of Persons Obtaining NOCA Backcountry Permits in 1993*

ORIGIN			Percent	Number
WEST COAST STATES	Percent	Number		
Washington				
Greater Seattle Area	52%	2,049		
Whatcom County	9%	357		
Skagit County	6%	226		
Chelan County	4%	157		
Okanogan County	2%	83		
Other	6%	231		
Washington Subtotal	79%	3,103		
Oregon	4%	152		
California	3%	131		
WEST COAST STATES SUBTOTAL	86%	3,386	86%	3,386
NORTHEAST STATES			4%	145
MIDWEST STATES			3%	109
CANADA			2%	96
SOUTHEAST STATES			2%	74
INTERMOUNTAIN WEST STATES			1%	46
SOUTHWEST STATES			1%	35
EUROPE			1%	34
OTHER			--	19

* Data compiled from 3,944 of the 4,207 permits (94%) issued in 1993.

Climbing

Mountaineering activity in North Cascades has almost tripled over the past 15 years and this trend is expected to continue. Publications (such as the guidebook *Selected Climbs in the Cascades*, published by the Mountaineers in the late fall of 1993), and magazine articles (such as the December 1993/January 1994 *Climbing* article "Looking for a wilderness experience? The Pickets, Washington") encourage greater use, and increase the popularity of formally rarely visited areas.

Safety is encouraged through the "Climbing Safety Program" which includes an annual newsletter, poster, displays and patrols. 1993 Climbing Safety projects included the publication of the second issue of *Climbing Notes*, the addition of a climbing safety display at the Wilderness Information Office, the revision of the *Voluntary Climber Register*, review of a draft of *Selected Climbs in the Cascades*, and communication with *Response* magazine in reference to the Park's SAR's.

A Climbing Safety Fund was established in 1993, and generated \$2,800 in donations the first year.

Writer Jeff Smoot recently compared mountaineering and climbing accident statistics for a number of areas, including North Cascades. Table 6-4 presents some of his data.

Table 6-4: Comparison of Mountaineering/Climbing Accident Rates

Ranked from highest to lowest by accident rate per 100,000 participants.

ACTIVITY	ACCIDENTS	FATALITIES
Mountaineering (Denali)	1,368	398
Mountaineering (general)	602	146
Rock climbing (Yosemite)	400+/-	18.3+/-
Mountaineering (Mt. Rainier)	341	24
Mountain Climbing (all types, including rock climbing)	320	45
Mountaineering (North Cascades)	98	18.6

Stock Use

Stock use in the Wilderness is light. Thirty-nine backcountry permits (1% of all permits) were issued to stock users in 1993. This level, 2% of the total backcountry use, is comparable to recent years.

The Stephen Mather Wilderness has forty-one stock campsites located at twenty-seven camps; this equals 19% of all wilderness campsites. In accordance with a long established policy, large parties of up to thirty people and stock are allowed at eight designated camps; McAlester Lake, Devil's Creek, Walker Park, Hidden Meadows, Fireweed, Lake Juanita, Reynolds, and Rainbow Meadow. This policy is under review as part of the General Management Plan for Lake Chelan NRA; the final is due out in 1995.

Stock impacts to the Triplet Lakes were observed for the first time in 1993. The lakes are located in a subalpine basin in the extreme southern end of the Wilderness and Lake Chelan NRA. They are in the Triplets Lakes Crosscountry Zone. Stock parties of up to a maximum size of six pairs of eyes are allowed to travel crosscountry in this opportunity class. Until recently these lakes were free of significant impacts. Early in 1993 a well-developed social trail from the Chelan Summit trail to the lakes and several denuded areas at the lakeshores were documented. In addition to private stock parties and licensed outfitters, impacts may be caused by non-licensed outfitters who are suspected of illegally entering the Wilderness and travelling to the lakes. These impacts will be closely monitored and consideration given to regulating use or closing the area to stock use.

Grazing

The Park has required stock users to obtain free grazing permits for a number of years. The lack of data suggests either extremely light demand for grazing from stock users, or the failure to enforce the requirement. In 1993 Wilderness Information Staff were encouraged to ask stock users if they planned to graze, and if so, to issue permits. In 1993, six grazing permits were issued. In 1994, this procedure was strengthened and permits are now being issued to all stock groups who indicate a desire to graze their animals.

The Park has not yet developed specific criteria for determining when to approve grazing requests, although there is an understanding that soil moisture in meadows should be an important consideration. One difficulty in implementing such a standard will be the sufficient staffing to regularly monitor conditions during critical periods.

In 1993 the Resources Management Division designed a study to measure grazing effects. This study was conducted as part of the Lake Chelan NRA Environmental Impact Study. Field work was conducted by both Wilderness District and Resources Management personnel. Preliminary review of the data suggests grazing pressure may be too light to quantify vegetation impacts.

Commercial Use

Table 6-5 lists the wilderness activity reported by Commercial Use Licensees in 1993.

Table 6-5: 1993 Commercial Activity

BUSINESS	GROUPS	TOTAL PERSONS	VISITOR DAYS
Adventure Associates	3	24	108
Alpine Ascents International	2	9	18
American Alpine Institute	25	84	176
Camp Nor'wester			
Cascade Corrals	3	38	230
Eastern Mountain Sports			
Global Community Institute			
Global Works			
Longacre Expeditions	2	24	228
Mountain Madness			
NOLS	11	97	920
Outward Bound	12	108	540
Reachout Expeditions	5	54	282
Sierra Club	8	90	390
Wilderness Ventures	2	12	70
Totals	73	540	2,962

Reports over the past two years indicate several horsepacking businesses are using the Twisp/McAlester/Lake Juanita areas without permits. These groups have been contacted, and are aware of Park regulations. No prosecutions have occurred because they have not been observed by law enforcement commissioned personnel inside the Park.

Section 7: Wilderness Education



Wilderness education is a cornerstone of wilderness management and a critical tool for increasing public awareness about wilderness policy, affecting attitude and behavioral changes, and developing an outdoor ethic. Getting wilderness users to voluntarily adopt minimum impact practices is the least intrusive way of eliminating avoidable resource damage, preserving the natural landscape and protecting the quality of wilderness experience. Wilderness education helps lessen the need for restrictions, closures, regulations, and law enforcement. The North Cascades program includes the Wilderness Center, visitor centers, information stations, interpretive programs, off-site education, bulletin boards, ranger contacts in the field, and publications.

Education specifically about wilderness is available to the park's visitors through certain interpretive programs, visitor center and information station exhibits, and the 1994 issue of "The Challenger," an informational newspaper for visitors. This paper is mailed out to thousands of people requesting information about North Cascades and the nearby National Forests, which include several wilderness areas. Public education takes place through the presentation of interpretive programs at park campgrounds, visitor center exhibits and audiovisual programs, and at other locations in the park. Some of these programs focus on wilderness and the others touch on aspects of it.

Wilderness Information Center

A Wilderness Information Center at Marblemount serves as the Park's central information exchange for backcountry related information. A permit is required for camping in the Stephen Mather wilderness. Permits are available at eleven locations:

National Park Service Facilities

- Wilderness Information Center
- Stehekin - Visitor Center & Ranger Station
- Hozomeen Ranger Station
- Colonial Ranger Station
- Newhalem Visitor Center

Joint NPS & USFS Stations

- Chelan Ranger Station
- Glacier Public Service Center
- Sedro-Woolley (Headquarters) Information Station

Forest Service

- Darrington Ranger Station
- Twisp Ranger Station
- Winthrop/Early Winters Ranger Station

Wilderness permits are entered into the computer database to check on the availability of sites and specific conditions. The Wilderness Center provides information through personal contact, permit issuance, displays, book sales, and handouts. The Wilderness Information Center is generally open daily Memorial Day through September 30th, and weekends through October 24th.

In winter the Center is open as staff are available in the Ranger Station. During the year the District Ranger met with Mountaineers, Mt. Vernon High School, National Outdoor Leadership School, Outward Bound, Skagit Backcountry Horsemen, Skagit Mountain Rescue, Whatcom Backcountry Horsemen, and Whatcom Mountain Rescue and presented a minimum impact lecture at Western Washington University.

North Cascades Visitor Center

In late May of 1993, the North Cascades Visitor Center near Newhalem was opened with a ceremony marking the park's 25th anniversary and dedicating the building to the late Senator Henry M. Jackson. The senator played a key role in establishing both the park and adjacent U.S. Forest Service wilderness areas. With the completion of this visitor center, for the first time North Cascades has an adequate facility for providing park visitors with information and an overview of what the park is about. The exhibits in the North Cascades Visitor Center at Newhalem focus on the biological and geological elements (animals, plants, landscape, and their ecological relationships) composing wilderness in the North Cascades. The center's large screen slide program, which is shown five to ten times per day in the summer, is titled "A Meditation on Wilderness" and deals with the emotional, aesthetic, and visual aspects of North Cascades wilderness. The program stimulates discussion about what wilderness is and about differing personal experiences of it. In the fall of 1994, a twenty minute movie will be installed in the visitor center for regular showing in alternation with the slide program. The movie's descriptions of wilderness experiences in the words and voices of people familiar with the North Cascades will accompany spectacular footage.

On May 28, 1994, the park dedicated the Sterling Munro Trail; a boardwalk trail from the North Cascades Visitor Center through the forest to a spectacular view of the Picket Range. This view into the Stephen Mather Wilderness provides an opportunity for travelers on Highway 20 to gain an appreciation for wilderness.

All members of the Division of Interpretation's staff have some contact with wilderness users. All division employees are extensively involved with providing interpretive programs and/or information to the park's visitors. Many visitors have questions about hikes to take and about the nature of the park's resources, which leads to explanations of wilderness designation and what it means. Off-site programs to service groups, schools, and senior centers include a wilderness theme. Exhibits in the U.S. Forest Service's Glacier Public Service Center, which the National Park Service participates in staffing, and at the Golden West Visitor Center in Stehekin (Lake Chelan National Recreation Area) provide information about minimizing impact in wilderness.

Publications

The following is a list of the more common park-produced handouts and brochures distributed by the Wilderness Center.

Wilderness Use

1993 Wilderness Permit System Explained
Wilderness Site Reservations letter
Main Trails & Backcountry Camp Areas
Hiking in the North Cascades
Safe and Sane Backpacking for Minimum Impact
Highway 20 Hikes
Baker River Trail
Depot Creek Access to the Mount Redoubt Area
Big Beaver Trail Information
Cascade Pass Trail Information
Colonial Creek Campground - Easy Pass
Copper Ridge - Chilliwack Trail Information
Desolation Peak Trail Information
Diablo & Colonial Area Day Hikes
East Bank Trail Information
Easy Pass Trail Information
Hidden Lake Peak Trail Information
Lake Juanita Trail Information
McAlester Lake/McAlester Pass Trail Information
Monogram Lake Trail Information
Newhalem Area Day Hikes Information
Pacific Crest Trail form letter
Pacific Crest Trail Information
Pyramid Lake Trail Information
Rainbow Pass/Rainbow Lake Trail Information
Sourdough Mountain Trail Information
Stetattle Creek Trail Information
Thornton Lakes Trail Information
Thunder Creek Trail Information
Twisp Pass/Dagger Lake Trail Information
Grazing Permit
Stock Use Site-Bulletin
Voluntary Climber Register
Climbing in the North Cascades National Park
Boston Basin
Boston Basin Cross-Country Area
Requests to Kool-Aid Lake/Ptarmigan Traverse Users
Climbing Notes

Backcountry/Camping

Camping in the North Cascades, Public Campgrounds
Colonial Creek Campground
Newhalem Creek Campground
Highway 20 Tour
Goodell Creek Group Campgrounds
Accommodations and Services
Ross Lake National Recreation Area
Ross Lake Guide & Map
Ross Lake Caps and Distances
Ross Lake Fishing Regulations
Boating Regulations - Ross lake NRA
Fishing Information 1993/1994
Ross Lake Boat-In Campground Regulations
Diablo Lake
Boy Scout form letter

The 1994 issue of "The Challenger," the newspaper for visitors published jointly by North Cascades National Park and the Mt. Baker District of the Mt. Baker-Snoqualmie National Forest, particularly focuses on wilderness in recognition of the 30th anniversary of the Wilderness Act. The paper

includes a detailed article on minimum impact hiking and camping. Several other articles highlighted other aspects of wilderness and wilderness management.

Cascadia Wild: Protecting an International Ecosystem edited by Mitch Friedman and Paul Lindholdt was published by Frontier Publications and the Greater Ecosystem Alliance. This book reviews a history of the ecosystem and provides a blueprint for protecting and restoring the Greater North Cascades Ecosystem.

The cover article in the January/February 1994 issue of *National Parks* was titled: *Two Countries, One Wilderness* by Carmi Weingrod. The six page article was about ecosystem protection, wilderness, and creating an international park in the Cascades of Washington and British Columbia.

The Wilderness District staff reviewed and commented on a draft of a new climbing guide, *Selected Climbs in the Cascades* (Mountaineers, Seattle 1994) by Jim Nelson and Peter Potterfield. Extensive suggestions on minimum impact use were provided. This book is a guide to 90 climbs in the North Cascades and includes advice on climbing with a Wilderness ethic.

A new booklet on hiking trails in the Complex was recently published: *Popular Trails* (Northwest Interpretive Association, 1994). This booklet provides a description of all maintained trails in North Cascades NP and Ross Lake NRA and helps to better disperse hikers throughout the Stephen Mather Wilderness. It includes a chapter on minimum impact use in wilderness.

In 1993 the Wilderness District participated in the conceptual development of two videos: one on alpine minimum impact being produced by the Mt. Baker District of the Mt. Baker-Snoqualmie NF., and one on minimum impact in mountain parks being produced by the NPS. Final design and filming for both is scheduled for 1994. A minimum impact video was developed by Denver Service Center for the Park.

North Cascades Institute

North Cascades Institute is a non-profit organization that conducts educational seminars and research on environmental topics. The Institute was founded in 1986 with the purpose of increasing understanding and appreciation for the region and providing leadership and excellence in environmental education. The NPS provides support to the Institute through a Memorandum of Agreement and works cooperatively in developing and presenting many programs with a wilderness related theme. Programs in 1993 included the following:

Mountain School

- 25 classes, 750 fifth grade students plus 110 teachers and parents
- spring and fall three day camping-based program
- focus on wilderness and wild lands, ecosystem management, natural and cultural history, native Americans, wildlife, NOCA wilderness, and resource management

Skagit Watershed Education Project

- 50 classes, 1200 fourth and fifth grade students plus 175 teachers, parent-volunteers
- fall-winter-spring program which involves teacher training, all-day field trip for each class, pre- and post- classroom field trip visit
- focus on watersheds, land-use issues, natural resources management including wilderness in the upper watershed on NPS and USFS lands), salmon, bald eagles, natural and cultural history, careers in conservation field

Mountain Camp

- 5 week-long sessions for ages 10-14, 60 students participate

- summer program
- sessions focus on streams, forests, wildlife, wilderness, mountain ecosystems

Field Seminars

- 72 2-5 day long programs for adults, 500-600 students per year
- year-round program
- focus on natural and cultural history, wilderness, ecosystems and biodiversity

Elderhostel

- 11 week-long programs for seniors, 440 students per year
- year-round program
- focus on natural and cultural history, some include wilderness and wild lands, management issues in the North Cascades

North Cascades Environmental Learning Center

The Federal Energy Regulatory Commission license for Skagit #553 Hydroelectric Project within Ross Lake National Recreation Area expired in 1977. Seattle City Light SCL entered into negotiations with eleven intervenors including the NPS, USF&WS, BIA, three U.S. Native American Tribes, one Canadian First Nation, USFS, Washington Departments of Wildlife and Fisheries, North Cascades Institute and North Cascades Conservation Council. The NPS and other intervenors negotiated mitigation and enhancement measures required under the proposed relicensing that included funding for an environmental learning center. On April 23, 1991, the City of Seattle City Light Department, National Park Service, and North Cascades Institute signed a Memorandum of Agreement for an Environmental Learning Center to be constructed at Diablo Lake in Ross Lake NRA. The Environmental Learning Center will be funded by Seattle City Light and operated by North Cascades Institute. FERC is completing an Environmental Assessment for the Skagit License. The new license is expected to be signed later this year.

Trails Day

On Saturday June 4, the park sponsored a day long series of programs at the Newhalem Visitor Center to celebrate this national celebration. The event was advertised locally, in the mountaineers newsletter, at REI and with local trail & horse organizations. Highlights of the day included a horsepacking clinic, cross cut saw demonstration, an illustrated slide talk on trail construction, log winching, a slideshow on the history of revegetation, a seminar on wilderness management, and a temporary display on wilderness & revegetation.

Section 8: Administrative Facilities, Tools and Use of Motorized Equipment



Park Aircraft Use

There was no use of fixed-wing aircraft in 1993 and 1994. Fixed-wing aircraft are occasionally used in surveying wildlife, spotting fires and dropping retardant.

The Park manages helicopter use in and above wilderness through the following actions:

- Park policy limits non-emergency activity to Monday through Thursday during the primary use season (defined as July 4th through Labor Day).
- Program managers are encouraged to schedule helicopter activities outside the primary use season whenever possible. In 1993, Trails scheduled 60% of flights outside the primary use season. U.S. Geological Survey, Seattle City Light, and Chelan PUD scheduled all snotel maintenance flights so as to avoid this period.
- The Wilderness and Aviation Committee reviews (and recommends action) on project proposals requiring helicopter support.
- The Skagit District Ranger, in the collateral duty of Aviation Coordinator, reviews (and approves or rejects) all non-emergency flight requests.
- The Trails Foreman coordinates and schedules the flights of all Park functions to minimize both the number of flights, and the duration of time helicopters spend over the Wilderness.

As shown in Table 8-1, actions such as these are helping the Park decrease the impact of helicopters on the wilderness resource.

Table 8-1: Wilderness Helicopter Use, by Year

YEAR	FLIGHTS REQUESTED	FLIGHTS APPROVED	FLIGHT HOURS
1993	59	44	95
1992	79	65	144 (est)
1991	105	78	157 (est)

The 1993 decrease in helicopter hours was partly due to light activity for search and rescue and wildland fire as indicated in Table 8-2.

Table 8-2: 1993 Wilderness Helicopter Use, by Function

TYPE	FUNCTION	HOURS
NON-EMERGENCY	Trails - NPS	21.00
	Snotel Work - USGS, Seattle City Light, and Chelan PUD	21.00
	High Lakes Study - NPS Contract	18.60
	Glacier Study - NPS	14.00
	Maintenance of NPS Radio Repeaters	6.59
	Wilderness District Camps and Composters - NPS	2.00
	Wilderness District Restoration Projects - NPS	2.50
EMERGENCY	SAR - NPS	9.50
	Fire - NPS	00.00
TOTAL HOURS		95.19

The information in the above tables only reflect helicopter use in and above wilderness. In 1993, the Park also experienced 7.5 hours of non-wilderness helicopter activity. This activity was related to an erosion control project on Ross Lake.

Trails

There is a total of 386 trail miles in the Complex, over 300 of which are in Wilderness. According to 1992 survey, 253 miles of trail are in good condition, 89 miles are in fair condition and 44 miles are in poor condition. There is an estimated 5,295 yards of plank or corduroy.

The trail system is managed for the purpose of recreation and wilderness protection. The park's trail standards were established prior to wilderness designation. These standards need to be reviewed, and where appropriate to best meet wilderness purpose and objectives. Some new trails construction is needed and some existing trails need to be relocated, restored, or closed. Many of the 79 bridges in the Complex are in fair-poor condition. Bridges should be built only where the crossing is unsafe during the primary visitor season or where unacceptable bank damage or erosion will occur from visitors seeking a crossing. A complete evaluation of all bridges is needed to determine their condition and to evaluate whether they are necessary.

The Trails program maintains a string of twelve animals in Marblemount. During the summer four animals are moved to Stehekin to support operations there. The stock are used extensively. During the summer each string is out at least once every two weeks. The stock are used to support projects of all Divisions that occur in areas of the Park open to stock use. To reduce helicopter use, stock use is increasing and diversifying.

The Trails program administratively divides the Complex into three geographic zones: north, central, and south. They have found this to be effective way of planning, administering and utilizing

The Trails program administratively divides the Complex into three geographic zones: north, central, and south. They have found this to be effective way of planning, administering and utilizing trailcrews. Priorities for the three zones are:

North Zone

More than any area of the park, the northern trails have not received the necessary annual maintenance. This area tends to have fast growing dense brush. Emphasis is on repairing minor damage due to lack of annual maintenance. Like all areas in the Park, the northern area includes camps that need improvement and relocation. Sections of the Copper Mountain trail have been identified among the worst in the park and are a top priority for repair. The section from Copper Lookout to Copper Lake is extremely steep and rocky. This section will require extensive relocations and blasting. Copper Lake Camp is in need of reconstruction to protect this sensitive sub alpine environment. North of Copper Lake a short section of trail has been destroyed by a rock slide in the 1970's. The log stringer bridge over Brush Creek near the Brush Creek junction is probably the oldest bridge in the park. It has shown signs of deterioration and weakness for several years. Its location, on a highly used all purpose trail, requires that it be replaced soon. The Little Beaver trail was entirely reconstructed in the mid 1970's. Since then there have been several sections of trail severely damaged by avalanches. These sections have been made passable to foot traffic but are no longer safe for stock. These sections need to be returned to all purpose standards. The upper East side of Whatcom Pass is narrow, steep and rocky. A major effort is necessary to make this a safe all purpose trail. Little Beaver Creek has changed its course around the suspension bridge at the junction of the Big Beaver and Little Beaver trails. At times this is a hazardous crossing. In lower Little Beaver Valley, Creek and Perry Creek routinely change course and destroy sections of trail and/or create hazardous crossings. Surveys need to be completed here to determine what the best solutions are.

Central Zone

Upgrading camps and performing deferred maintenance of existing trails are the top priority. Three major stock bridges require replacement, Dry Creek, 39 Mile Creek, and Pierce Creek. The first two bridges will be replaced with foot logs and stock fords. This will minimize construction impacts and future maintenance needs. Preservation of historic structures, Sourdough Lookout and Desolation Lookout are high priorities. Several hundred feet of puncheon on the Big Beaver trail have deteriorated to a condition that has forced the closure of the trail to stock. This is scheduled to be replaced with rock turnpike and puncheon.

South Zone

A high percentage of backcountry camps require relocation to meet wilderness standards. The Rainbow Creek, Cascade Pass (south side), and Horseshoe Basin trails have been identified by the Wilderness Committee for upgrading to park standards. This will require extensive survey work. Reconstruction and relocations will be a major project for several seasons.

Camps

The backcountry of the North Cascades National Park Service Complex contains 341 campsites, 213 of which are in the Wilderness. They are situated in clusters at eighty different camps.

In 1993 the Wilderness District initiated a project to inventory and map the Wilderness campsites for compliance with standards as defined in the *Wilderness Management Plan*. Of the 116 campsites inventoried to-date, thirteen (11%) meet all standards. Table 8-6, located at the rear of this section, shows the present condition of all camps in the Mather Wilderness.

In addition to camping in established camps, "cross-country" camping is allowed in most of the Wilderness as long as a camp is one mile from an established camp, one half mile from a trail and 100 feet from any body of water.

Less than ten of the 213 Wilderness Camp meet IGBC recommended grizzly bear standards. The Park hasn't yet adopted a food storage standard. The Rainbow Lakes camp was recently reconstructed to meet Grizzly Bear standards. One of the Rainbow Meadow camps (horse/hiker) was reconstructed to meet Grizzly Bear standards. The camps were designed so that once a food-storage standard is established the camps can be brought up to date.

Composter

Problems of human waste disposal occur wherever and whenever people congregate. For every three kilograms of food and water ingested, one kilogram is eventually excreted as body waste. These fecal wastes may contain a wide variety of viral, bacterial, and protozoan pathogens which have been implicated in water-borne disease. In the rugged mountain landscape of the Stephen Mather Wilderness, campsites and trails concentrate visitors in subalpine areas, mountain passes and high lakes. The cold temperatures and thin mineral soils at higher elevation slow aerobic decomposition. Options in use in the Stephen Mather Wilderness include

- individual catholes
- wallowa toilets
- pit privies
- fiberglass vaults that are removed or emptied on a regular basis by helicopter
- Vaults with composting bins

In 1988, the park prepared a technical report evaluating *Composting Options for Wilderness Management of Human Waste in North Cascades National Park Service Complex*.

Wilderness Rangers in partnership with Trails, currently maintains fourteen composter toilets. A list of the location and status of these toilets is found in Table 8-3.

The composters are very successful in controlling human waste in the sub-alpine environment, but require a strong staff commitment. Depending upon level of use, they must be checked and serviced on a daily to monthly basis. The composter requiring the closest attention is situated at Cascade Pass. The loss of several positions in each of the past two years is straining the District's ability to keep the composters functioning. Many of the composters are of early experimental design, constructed of marine plywood, are suffering the ravages of weather and rodents, and are in need of replacement.

NPS staff has assisted Romtec Inc. with the design of a rotationally molded, polyethylene composter unit. Romtec is a manufacturer of toilet facilities used in recreational areas. The composter is a new product line for them, and if successful will allow other land management units to adopt composting technology. It will also improve the acquisition process for the Park, and make replacement of broken parts simpler.

The Wilderness District recently conducted a complete inventory of the composters, and began detailed records to document use, maintenance, and condition over the life of the units. There is a need to purchase and install at least one recording thermometer to study the effectiveness of the composting action in destroying pathogens. Written health guidelines and formal training for compost maintenance to protect the health and safety of employees and reduce the risk of hepatitis and other infectious disease.

Table 8-3: Location and Status of Compost Toilets

LOCATION	DESCRIPTION AND YEAR INSTALLED	STATUS AND DATE OF LAST INSPECTION
Boston Basin, Lower Camp	One new 1992 bin. Box toilet with vault.	1/3 full (7/93). Top upgraded to direct deposit (7/94).
Boston Basin, Upper Camp	Fiberglass direct deposit. 1992.	1/3 full, dry, looks good (8/93).
Cascade Pass	Direct deposit, 1992. A second fiberglass bin, 1993.	Over wet summer, direct deposit filled with waste. A second bin and peat moss were flown in. In late August waste was shoveled into second bin, and mixed with peat moss.
Copper Lake	One fiberglass coated plywood composting vault; Wallowa with 5 gal. bucket.	Near full, composting well, (8/93). <i>Recommend be replaced with fiberglass direct deposit.</i>
Copper Lookout	Box toilet with bucket. Fiberglass composting vault.	Full fiberglass coated plywood composting vault flown out in early summer of 1993. Remaining fiberglass vault near empty. (9/93). <i>Recommend top of fiberglass vault be upgraded to direct deposit.</i>
Egg Lake	Direct deposit, new 1992.	About 1/2 full, damp, good, (7/93). Old composter, full of old broken-up toilets, tied shut with ropes. Needs to be removed.
Monogram Lake	Plywood direct deposit, earliest model.	Good condition, 3/5 full (7/93). Nearing end of usefulness: sagging, marmots have gnawed hole. <i>Recommend it be upgraded to direct deposit.</i>
Pelton Basin	Vault, wallowa, bucket. 1992.	Good condition, less than 1/3 full (7/93). <i>Recommend top be upgraded to direct deposit.</i>
Pelton Basin Ranger Camp	Direct deposit. 1992.	Too wet, <i>needs peat moss</i> , less than 1/4 full (7/93).
Sahale	Vault, wallowa, bucket. 1992.	Good condition, about 1/3 full (7/93). <i>Upgrade top of vault to direct deposit.</i>
Silesia	Direct deposit, new 1992.	Good condition, 1/3 to 1/2 full, dry (7/93).
Thornton Lakes	Wood box toilet with fiberglass vault. Second bin fiberglass coated plywood.	Over wet summer of '93 composter was full and very wet. In late August a new lid was installed on fiberglass coated wood bin. Waste then shovelled into this second bin, and mixed with 2/3 bag of peat moss.
Thunder Basin.	Installed 7/93.	
Whatcom Pass.	Wallowa with 5 gal. bucket. Fiberglass compost bin, insulated. 1990? Composter also receives waste backpacked from Whatcom Pass Ranger Camp.	Good condition, less than 1/4 full (7/93).

Radio Communications

The Park's high-band FM radio system provides radio coverage of the Complex for emergency use and the administration of the Park. There are radio repeater sites located at McGregor Mountain, Ruby Mountain and Easy Ridge. Repeater sites at Mt. Shuksan and Little Jack Mountain were relocated to the present, less conspicuous sites. The sites require an annual helicopter flight to replace batteries and service the duplexers.

Snow Survey Sites

The United States Geological Survey, State of Washington Department of Natural Resources, Seattle City Light and Chelan PUD cooperatively maintain snow survey sites in the Stephen Mather Wilderness. They are part of a statewide network of snow survey sites dating back to 1915 that provides data used for forecasting water levels, drought index, flooding and fire danger. The Park is negotiating with USGS, Seattle City Light and Chelan PUD to reduce helicopter flights and to remove all non-essential human debris.

Table 8-4: Location of Snotel Sites within Stephen Mather Wilderness

Site Name	Number	Year	Lat	Long	Elev
Beaver Creek Trail	21A04	1944	48'50"	121'12"	2200
Beaver Pass	21A01	1944	48'53"	121'15"	3680
Easy Pass	21A07A	1959	48'52"	121'26"	5200
Jasper Pass	21A06A	1959	48'57"	121'24"	5400
Lake Hozomeen	21A02	1951	48'57"	121'02"	2600
Meadow cabin	20A08	1945	48'35"	120'02"	1900
Park Creek Ridge	20A12A	1929	48'27"	120'55"	4600
Peterson's	20A16A	1930	48'28"	120'43"	3730
Rainy Pass	20A09	1943	48'34"	120'43"	4780
Thunder Basin	20A07	1944	48'31"	120'59"	4200

Summit Registers

The Seattle Mountaineers began placing summit registers at peaks throughout the Northern Cascades and Olympic Mountains in the early part of the century. It is still their policy to provide brass cylinders to members to place on peaks that they climb. The Mountaineers have been contacted to request that no additional cylinders be placed until a final decision on the appropriateness of registers in wilderness is determined. The NPS is attempting to undertake a survey of which summits have registers, the year they were installed, and whether they are consistent with 'minimum tool' guidelines.

Ranger Backcountry Camps

To minimize the number of structures in wilderness, the North Cascades utilizes temporary tent camps for wilderness ranger camps rather than cabins or permanent structures. Tent platforms, a food storage box, and pit toilets are located at unobtrusive locations near Whatcom Pass, Cascade Pass, Twisp Pass, McAlester Passes, and Juanita Lake. These camps are stocked once annually by helicopter or stock.

Trailheads

The Wilderness has fifty entry points. They range from popular primary accesses such as Cascade Pass, to very lightly used crosscountry travel corridors such as Depot Creek. Table 8-5 lists, for each entry point, associated trailhead, distance to trailhead, trailhead ownership, type of bulletin board at each trailhead, and Park division responsible for upkeep of NPS information.

Table 8-5: Entry Point Inventory and Use

ENTRY POINT	PERMITTED PARTIES ENTERING IN 1993		BOUNDARY SIGN	DISTANCE TO TRAILHEAD	TRAILHEAD	AGENCY OWNERSHIP OF TRAILHEAD	TYPE OF BULLETIN BOARD	PARK FUNCTION RESPONSIBLE FOR NPS INFORMATION
	#	%						
Agnes Creek	1	<1%		500 feet	Stehekin Road	NPS		Stehekin District
Bacon Creek	1	<1%		2 miles	Bacon Creek Road	USFS	4'x3' signboard	Wilderness District
Baker River	20	1%	Nailed to tree	1 mile	Baker River trailhead	USFS		Wilderness District
Boston Basin	84	4%	N/A	100 feet	Cascade River Road	NPS	10"x16" signboard	Wilderness District
Bridge Creek	93	4%	Yes	3 miles	Bridge Creek parking area on Hwy 20	USFS	10"x16" signboard; large three panel display (permanent map and two bulletin boards) (new, 1993)	Skagit Interpretation
Cache Col	0	0%		Multi-day hike	Glacier Peak Wilderness	USFS		Wilderness District
Cascade Pass	258	12%	N/A	100 feet	Cascade River Road	NPS	Large, three panel display (permanent map and two bulletin boards)	Wilderness District

ENTRY POINT	PERMITTED PARTIES ENTERING IN 1993		BOUNDARY SIGN	DISTANCE TO TRAILHEAD	TRAILHEAD	AGENCY OWNERSHIP OF TRAILHEAD	TYPE OF BULLETIN BOARD	PARK FUNCTION RESPONSIBLE FOR NPS INFORMATION
	#	%						
Chelan Summit	1	<1%		Multi-day hike	Lake Chelan - Sawtooth Wilderness	USFS		Wilderness District
Chilliwack Lake	4	<1%	No	3 miles	Chilliwack Lake	British Columbia	10"x16" signboard	Wilderness District
Company Creek	1	<1%		1,000 feet	Stehekin Road	NPS		Stehekin District
Cottonwood	2	<1%	N/A	500 feet	Stehekin Road	NPS		Stehekin District
Depot Creek	3	<1%	N/A	20 feet	Depot Creek logging road	British Columbia	10"x16" signboard with register box	Wilderness District
Devil's Creek	7	<1%		Multi-day hike	Pasayten Wilderness	USFS		Wilderness District
Devore Creek	0	0%	N/A	500 feet	Stehekin	NPS		Stehekin District
Diablo	84	4%	N/A	0.5 miles	Diablo, Hwy. 20	NPS		Skagit Interpretation
East Bank (Ruby Creek)	46	2%	N/A	1,000 feet	East Bank trailhead on Hwy. 20	NPS	Large, three panel display (permanent map and two bulletin boards)	Skagit Interpretation
Easy Pass	32	1%		3 miles	Easy Pass trailhead, Hwy. 20	USFS	Large, three panel display (permanent map and two bulletin boards)	Wilderness District

Section 8: Administrative Facilities, Tools and Use of Motorized Equipment

ENTRY POINT	PERMITTED PARTIES ENTERING IN 1993		BOUNDARY SIGN	DISTANCE TO TRAILHEAD	TRAILHEAD	AGENCY OWNERSHIP OF TRAILHEAD	TYPE OF BULLETIN BOARD	PARK FUNCTION RESPONSIBLE FOR NPS INFORMATION
	#	%						
Eldorado	25	1%	N/A	500 feet	Cascade River Road	NPS	None	Wilderness District
Flat Creek	0	0%	N/A	500 feet	Stehekin Road	NPS		Stehekin District
Flick Creek	1	<1%		Multi-day hike	Lake Chelan - Sawtooth Wilderness	USFS		Wilderness District
Freezeout	0	0%		Multi-day hike	Pasayten Wilderness	USFS		Wilderness District
Goodell Creek	11	1%	N/A	1,000 feet	Goodell Creek, Hwy. 20	NPS		
Hannegan	118	6%	Yes	5 miles	Hannegan Pass trailhead	USFS	Large, three panel display (permanent map and two bulletin boards)	Wilderness District
Hidden Lake	26	1%		2 miles	Hidden Lake Road	USFS		Wilderness District
Hozomeen	44	2%	N/A	2 miles	Hozomeen	NPS		Skagit District
Maple Pass	0	0%	N/A	100 feet	Stehekin Road	NPS		Stehekin District
McGregor	0	0%	N/A	100 feet	Stehekin Road	NPS		Stehekin District
Monogram Lake	18	1%	Yes	4 miles	Monogram Lake trailhead	USFS	Several 10"x16" signboards	Wilderness District
Newhalem Creek	1	<1%	N/A	1 mile	Newhalem, Hwy. 20	NPS		

ENTRY POINT	PERMITTED PARTIES ENTERING IN 1993		BOUNDARY SIGN	DISTANCE TO TRAILHEAD	TRAILHEAD	AGENCY OWNERSHIP OF TRAILHEAD	TYPE OF BULLETIN BOARD	PARK FUNCTION RESPONSIBLE FOR NPS INFORMATION
	#	%						
Noisy Creek	1	<1%		3 miles	Baker Lake	USFS		Wilderness District
Nooksack	7	<1%		8 miles	Hannegan Pass Road	USFS		Wilderness District
Panther Creek	12	1%	N/A	500 feet	Panther Creek, Hwy. 20	NPS	45"x22" signboard	Wilderness District
Park Creek	2	<1%	N/A	100 feet	Stehekin Road	NPS		Stehekin District
Pyramid Creek	16	1%	N/A	0.5 miles	Diablo, Hwy. 20	NPS	39"x38" bulletin board	Wilderness District
Rainbow Creek	1	<1%	N/A	100 feet	Stehekin Road	NPS		Stehekin District
Rainy Pass	33	2%		2 miles	Rainy Pass parking lot, Hwy. 20	USFS	Large, 3 panel display. No boards for notices.	Wilderness District
Ross Dam (Happy Flat)	181	8%	N/A	1 mile	Ross Dam parking lot, Hwy. 20	NPS	Large, three panel display (permanent map and two bulletin boards)	Skagit Interpretation
Shuksan (Lake Ann)	3	<1%		4 miles	Heather Meadows	USFS		Wilderness District
Shuksan (Price)	1	<1%		5 miles	Hannegan Pass Road	USFS		Wilderness District
Shuksan (Sulphide)	35	2%	No	3 miles	USFS logging road 014	USFS	None	Wilderness District

Section 8: Administrative Facilities, Tools and Use of Motorized Equipment

ENTRY POINT	PERMITTED PARTIES ENTERING IN 1993		BOUNDARY SIGN	DISTANCE TO TRAILHEAD	TRAILHEAD	AGENCY OWNERSHIP OF TRAILHEAD	TYPE OF BULLETIN BOARD	PARK FUNCTION RESPONSIBLE FOR NPS INFORMATION
	#	%						
Shuksan (White Salmon)	2	<1%		2 miles	Heather Meadows	USFS		Wilderness District
Sourdough	4	<1%	N/A	0.5 miles	Diablo, Hwy. 20	NPS	Large, three panel display (permanent map and two bulletin boards)	Skagit Interpretation
South Pass (McAlester)	1	<1%	Nailed to tree	7 miles	South Creek, along Twisp River Road	USFS	5'x3' bulletin board	Wilderness District
Stehekin	375	17%	N/A	500 ft.	Stehekin	NPS	A variety of interpretive displays and bulletin boards	Stehekin District
Stetattle Creek	1	<1%	N/A	0.5 miles	Diablo, Hwy. 20	NPS		Wilderness District
Thornton Creek (Lakes)	49	2%	N/A	2 miles	Thornton Lakes Road	NPS	Large, three panel display (permanent map and two bulletin boards) on road; 2'x4' bulletin board at trailhead	Skagit Interpretation
Thunder Creek (Colonial Campground)	272	13%	N/A	2 miles	Colonial Creek, Hwy. 20	NPS	70"X40" timber bulletin board with roof	Wilderness District

ENTRY POINT	PERMITTED PARTIES ENTERING IN 1993		BOUNDARY SIGN	DISTANCE TO TRAILHEAD	TRAILHEAD	AGENCY OWNERSHIP OF TRAILHEAD	TYPE OF BULLETIN BOARD	PARK FUNCTION RESPONSIBLE FOR NPS INFORMATION
	#	%						
Three Fools	4	<1%		Multi-day hike	Pasayten Wilderness	USFS		Wilderness District
Twisp Pass	15	1%	Nailed to tree	4 miles	Twisp River Road	USFS	4'x3' bulletin board	Wilderness District
War Creek	3	<1%	Yes	9 miles	Twisp River Road	USFS	4'x3' bulletin board	Wilderness District

Table 8-6: Campsite Inventory

CAMPSITE COMPLIANCE WITH WILDERNESS PLAN STANDARDS, 1993/1994 INVENTORIES

<u>CAMPSITE</u>	<u>TENT PADS</u>	<u>100 FT. FROM WATER</u>	<u>SCREENED FROM TRAIL</u>	<u>SCREENED FROM OTHER SITES</u>	<u>FREE OF IMPROVEMENTS</u>	<u>TOILET 200 FT FROM WATER</u>	<u>FIRE GRATE</u>	<u>SIGNS</u>	<u>BEAR POLE, CABLE, LIMB</u>	<u>STANDARD MET</u>
39 Mile 1	1									
39 Mile 2	2									
39 Mile Stock 1	2									
39 Mile Stock 2	1									
Basin Creek 1	1	NO	YES	YES	YES	YES	YES	YES	YES	YES
Basin Creek 2	2	NO	YES	YES	YES	YES	YES	YES	YES	YES
Basin Creek 3	2	NO	YES	YES	YES	YES	YES	YES	YES	YES
Basin Creek 4	1	NO	YES	YES	YES	YES	YES	YES	YES	YES
Basin Creek 5	3	NO	YES	YES	YES	YES	YES	YES	YES	YES
Basin Creek 6	1	NO	YES	YES	YES	YES	YES	YES	YES	YES
Bear Creek	2	YES	YES	YES	YES	NO	NO	NO	NO	NO
Beaver Pass 1	2	NO	YES	NO	YES	YES	YES	YES	YES	NO
Beaver Pass 2	3	NO	YES	NO	NO	YES	YES	YES	YES	NO
Beaver Pass Stock	4									
Bench Creek 1	3	YES	NO	NO	NO	YES	YES	NO	YES	NO
Bench Creek 2	2	YES	NO	NO	NO	YES	YES	NO	YES	NO
Bench Creek 3	2	YES	NO	NO	NO	YES	YES	NO	YES	NO
Big Beaver Stock	3									
Boundary 1	1	NO	NO	YES	YES	YES	N/A	NO	NO	NO
Boundary 2	1	NO	YES	YES	YES	YES	N/A	YES	NO	NO
Boundary 3	1	NO	YES	YES	YES	YES	N/A	YES	NO	NO
Bowan 1	1	YES	NO	YES	NO	YES	YES	NO	YES	NO
Bowan 2	1	YES	YES	YES	YES	YES	YES	NO	YES	NO
Buckner	3	NO	NO	YES	YES	YES	YES	NO	YES	NO
Bullion 1	2									
Bullion 2	2									
Copper Cr. Stock 1	2	NO	NO	NO	NO	YES	YES	NO	YES	NO
Copper Cr. Stock 2	2	NO	YES	NO	NO	YES	YES	NO	YES	NO
Copper Cr. Stock 3	1									
Copper Creek 1	1	NO	YES	YES	YES	YES	YES	NO	YES	NO
Copper Creek 2	1	NO	YES	YES	YES	YES	YES	NO	YES	NO
Copper Creek 3	1	NO	YES	YES	YES	YES	YES	NO	YES	NO
Copper Lake 1	1	NO	NO	YES	YES	YES	N/A	YES	YES	NO
Copper Lake 2	2	YES	YES	YES	YES	YES	N/A	YES	YES	YES
Copper Lake 3	1	NO	NO	YES	YES	YES	N/A	YES	YES	NO
Cosho 1	2	NO	NO	YES	YES	YES	YES	NO	NO	NO
Cosho 2	1	NO	NO	YES	YES	YES	YES	NO	NO	NO
Cosho 3	1	NO	NO	YES	NO	YES	YES	NO	NO	NO
Dagger Lake	3									
Dagger Lake Stock	2									

Table 8-6: Campsite Inventory**CAMPSITE COMPLIANCE WITH WILDERNESS PLAN STANDARDS, 1993/1994 INVENTORIES**

CAMPSITE	TENT PADS	100 FT. FROM WATER	SCREENED FROM TRAIL	SCREENED FROM OTHER SITES	FREE OF IMPROVEMENTS	TOILET 200 FT FROM WATER	FIRE GRATE	SIGNS	BEAR POLE, CABLE, LIMB	STANDARD MET
Dan's	1	NO	NO	YES	NO	NO	YES	YES	YES	NO
Deerlick 1	1									
Deerlick 2	2									
Deerlick Stock	2									
Desolation	3	YES	YES	YES	YES	YES	NO	NO	NO	NO
Devil's Hiker 1	3									
Devil's Hiker 2	2									
Egg Lake 1	1	NO	NO	NO	YES	NO	N/A	YES	YES	NO
Egg Lake 2	2	NO	NO	NO	YES	NO	N/A	YES	YES	NO
Egg Lake 3	1	NO	NO	NO	YES	NO	N/A	YES	YES	NO
Fireweed 1	2	NO	NO	NO	YES	YES	YES	NO	YES	NO
Fireweed 2	2	NO	NO	NO	YES	YES	YES	NO	YES	NO
Fireweed Stock 1	4	YES	YES	NO	YES	NO	YES	NO	NO	NO
Fireweed Stock 2	2	YES	YES	NO	YES	NO	YES	NO	NO	NO
Fireweed Stock 3	1	NO	YES	NO	NO	NO	YES	NO	NO	NO
Fisher 1	2	YES	YES	NO	YES	NO	N/A	YES	NO	NO
Fisher 2	1	YES	YES	NO	YES	NO	N/A	YES	NO	NO
Fisher 3	1	YES	YES	YES	YES	NO	N/A	YES	YES	NO
Five Mile Stock 1	1	NO	NO	NO	YES	YES	YES	NO	YES	NO
Five Mile Stock 2	1	YES	NO	NO	YES	YES	YES	NO	YES	NO
Five Mile Stock 3	3	NO	NO	NO	YES	YES	YES	NO	YES	NO
Flat Creek 1	1									
Flat Creek 2	1									
Flat Creek 3	1									
Flat Creek 4	1									
Fourth of July 1	1									
Fourth of July 2	2									
Fourth of July 3	2									
Graybeal	6	YES	YES	YES	YES	YES	YES	NO	YES	NO
Graybeal Stock	4	YES	NO	YES	YES	YES	YES	NO	YES	NO
Grizzly Cr. Stock	1									
Grizzly Creek 1	1									
Grizzly Creek 2	1									
Heaton Stock	2									
Hidden Lake 1	1									
Hidden Lake 2	2									
Hidden Lake 3	2									
Hidden Mdws Stock 1	2									
Hidden Mdws Stock 2	2									
Hideaway 1	2	NO	YES	NO	YES	YES	YES	NO	YES	NO

Table 8-6: Campsite Inventory

CAMPSITE COMPLIANCE WITH WILDERNESS PLAN STANDARDS, 1993/1994 INVENTORIES

<u>CAMPSITE</u>	<u>TENT PADS</u>	<u>100 FT. FROM WATER</u>	<u>SCREENED FROM TRAIL</u>	<u>SCREENED FROM OTHER SITES</u>	<u>FREE OF IMPROVEMENTS</u>	<u>TOILET 200 FT FROM WATER</u>	<u>FIRE GRATE</u>	<u>SIGNS</u>	<u>BEAR POLE, CABLE, LIMB</u>	<u>STANDARD MET</u>
Hideaway 2	6	NO	YES	NO	YES	YES	YES	NO	YES	NO
High	2	YES	YES	YES	YES	YES	N/A	NO	YES	YES
Hooter	2	YES	NO	NO	NO	NO	N/A	NO	YES	NO
Hozomeen 1	2									
Hozomeen 2	2									
Hozomeen 3	2									
Indian Creek 1	1	NO	NO	NO	NO	YES	YES	NO	NO	NO
Indian Creek 2	2	NO	NO	NO	NO	YES	YES	NO	NO	NO
Johannesburg 1	1									
Johannesburg 2	1									
Johannesburg 3	1									
Juanita Lake 1	1	YES	NO	NO	YES	NO	YES	YES	YES	NO
Juanita Lake 2	1	YES	NO	NO	YES	NO	YES	YES	YES	NO
Juanita Lake 3	1	NO	YES	NO	YES	NO	YES	NO	YES	NO
Juanita Lake 4	2	YES	YES	YES	YES	NO	YES	NO	YES	NO
Juanita Lake Stock	5	NO	NO	NO	NO	NO	YES	NO	YES	NO
Junction 1	2	YES	YES	YES	YES	YES	YES	YES	YES	YES
Junction 2	6	YES	YES	YES	YES	YES	YES	NO	YES	NO
Junction 3	2	YES	YES	YES	YES	YES	YES	NO	YES	NO
Junction Stock	3	YES	YES	YES	NO	YES	YES	YES	NO	NO
Little Chilliwack 1	1	NO	YES	YES	YES	YES	YES	NO	NO	NO
Little Chilliwack 2	1	YES	YES	YES	YES	YES	YES	NO	NO	NO
Little Chilliwack 3	1	YES	YES	YES	YES	YES	YES	NO	NO	NO
Luna 1	2									
Luna 2	2									
Luna Horse										
McAlester Lake 1	2									
McAlester Lake 2	3									
McAlester Lk. Stock 1	2									
McAlester Lk. Stock 2	1									
McAllister 1	2									
McAllister 2	2									
McAllister 3	2									
McAllister 4	2									
McAllister 5	2									
McAllister Stock	2									
Monogram Lake 1	2	NO	NO	YES	YES	YES	N/A	YES	NO	NO
Monogram Lake 2	3	NO	YES	YES	YES	YES	N/A	YES	NO	YES
Neve 1	2									
Neve 2	2									

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CAMPSITE COMPLIANCE WITH WILDERNESS PLAN STANDARDS, 1993/1994 INVENTORIES

<u>CAMPSITE</u>	<u>TENT PADS</u>	<u>100 FT. FROM WATER</u>	<u>SCREENED FROM TRAIL</u>	<u>SCREENED FROM OTHER SITES</u>	<u>FREE OF IMPROVEMENTS</u>	<u>TOILET 200 FT FROM WATER</u>	<u>FIRE GRATE</u>	<u>SIGNS</u>	<u>BEAR POLE, CABLE, LIMB</u>	<u>STANDARD MET</u>
Neve 3	2									
Newhalem Cr. Stock	3									
Nightmare	2									
Nightmare Stock	3									
Northfork 1	3									
Northfork 2	4									
Old Cottonwood 1	2									
Old Cottonwood 2	2									
Old Cottonwood 3	2									
Panther 1	1									
Panther 2	2									
Pelton Basin 1	2	YES	YES	NO	YES	YES	N/A	NO	YES	NO
Pelton Basin 2	2	YES	YES	NO	YES	YES	N/A	NO	YES	NO
Pelton Basin 3	2	YES	YES	NO	YES	YES	N/A	NO	YES	NO
Perry Creek 1	1	YES	YES	YES	NO	YES	NO	NO	YES	NO
Perry Creek 2	3	YES	YES	YES	NO	YES	NO	NO	YES	NO
Pierce Mountain	1	YES	YES	YES	YES	NO	NO	YES	YES	NO
Pumpkin Mtn 1	1									
Pumpkin Mtn 2	1									
Rainbow Bridge 1	1									
Rainbow Bridge 2	1									
Rainbow Bridge 3	2									
Rainbow Ford	2	NO	NO	YES	YES	YES	NO	YES	NO	NO
Rainbow Lake 1	1									
Rainbow Lake 2	2									
Rainbow Lake 3	3									
Rainbow Mdws	6	YES	YES	YES	NO	YES	YES	NO	YES	NO
Rainbow Mdws Stock 1	4									
Rainbow Mdws Stock 2	2									
Rennie	3	YES	NO	YES	NO	NO	YES	NO	YES	NO
Reynolds	2	YES	YES	YES	YES	YES	YES	NO	YES	NO
Reynolds Stock	2	NO	NO	YES	NO	YES	YES	NO	YES	NO
Roland Creek 1	2									
Roland Creek 2	2									
Ruby Pasture Stock	2									
Sahale Glacier 1	3	YES	NO	NO	NO	YES	N/A	NO	NO	NO
Sahale Glacier 2	2	YES	NO	NO	NO	YES	N/A	NO	NO	NO
Sahale Glacier 3	1	YES	NO	NO	NO	YES	N/A	NO	NO	NO
Sahale Glacier 4	1	YES	NO	NO	NO	YES	N/A	NO	NO	NO
Sahale Glacier 5	1	YES	NO	NO	NO	YES	N/A	NO	NO	NO

Table 8-6: Campsite Inventory

CAMPSITE COMPLIANCE WITH WILDERNESS PLAN STANDARDS, 1993/1994 INVENTORIES

CAMPSITE	TENT PADS	100 FT. FROM WATER	SCREENED FROM TRAIL	SCREENED FROM OTHER SITES	FREE OF IMPROVEMENTS	TOILET 200 FT FROM WATER	FIRE GRATE	SIGNS	BEAR POLE, CABLE, LIMB	STANDARD MET
Silesia 1	1	YES	NO	NO	YES	YES	N/A	NO	NO	NO
Silesia 2	3	YES	YES	NO	YES	YES	N/A	NO	NO	NO
Six Mile 1	1									
Six Mile 2	2									
Skagit Queen 1	2	YES	YES	YES	YES	YES	YES	NO	YES	NO
Skagit Queen 2	2	YES	YES	YES	YES	YES	YES	NO	YES	NO
Skagit Queen 3	1	YES	YES	YES	YES	YES	YES	NO	YES	NO
Skagit Queen Stock	2	YES	YES	YES	YES	YES	YES	NO	YES	NO
Sourdough	1	NO	NO	YES	YES	NO	NO	NO	YES	NO
South Fork 1	6	NO	NO	NO	NO	YES	YES	NO	YES	NO
South Fork 2	4	NO	NO	NO	YES	YES	YES	NO	YES	NO
South Fork 3	1	NO	YES	YES	YES	YES	YES	NO	YES	NO
South Fork Stock	1	YES	YES	YES	YES	YES	YES	YES	YES	YES
Stillwell 1	2									
Stillwell 2	2									
Stillwell 3	2									
Stillwell 4	2									
Sulphide 1	3	YES	YES	NO	YES	NONE	YES	NO	YES	NO
Sulphide 2	6	YES	YES	NO	YES	NONE	YES	NO	YES	NO
Thornton Lake 1	1									
Thornton Lake 2	2									
Thornton Lake 3	2									
Thunder 1	2									
Thunder 2	2									
Thunder 3	2									
Thunder Basin	1	NO	YES	YES	YES	YES	N/A	NO	YES	NO
Thunder Basin Stock	3	NO	YES	YES	YES	YES	N/A	NO	YES	NO
Trapper Inlet 1	2	NO	YES	NO	YES	N/A	N/A	YES	NO	NO
Trapper Inlet 2	3	NO	YES	NO	YES	N/A	N/A	YES	NO	NO
Trapper Outlet 1	2									
Trapper Outlet 2	2									
Tricouni 1	2	YES	YES	YES	YES	YES	YES	YES	YES	YES
Tricouni 2	2	YES	YES	YES	YES	YES	YES	YES	YES	YES
Twin Rocks 1	1	YES	NO	NO	YES	NO	YES	NO	YES	NO
Twin Rocks 2	3	NO	NO	NO	NO	NO	YES	NO	YES	NO
Twin Rocks 3	1	YES	YES	NO	YES	NO	YES	NO	YES	NO
Twin Rocks 4	1	NO	YES	NO	YES	NO	YES	NO	YES	NO
Twin Rocks Stock	3	NO	NO	YES	NO	NO	YES	NO	YES	NO
Two Mile	1	NO	NO	YES	NO	YES	YES	YES	YES	NO
US Cabin 1	1	NO	YES	NO	YES	NO	YES	NO	YES	NO

Table 8-6: Campsite Inventory**CAMPSITE COMPLIANCE WITH WILDERNESS PLAN STANDARDS, 1993/1994 INVENTORIES**

<u>CAMPSITE</u>	<u>TENT PADS</u>	<u>100 FT. FROM WATER</u>	<u>SCREENED FROM TRAIL</u>	<u>SCREENED FROM OTHER SITES</u>	<u>FREE OF IMPROVEMENTS</u>	<u>TOILET 200 FT FROM WATER</u>	<u>FIRE GRATE</u>	<u>SIGNS</u>	<u>BEAR POLE, CABLE, LIMB</u>	<u>STANDARD MET</u>
US Cabin 2	1	NO	YES	NO	YES	NO	YES	NO	YES	NO
US Cabin 3	3	NO	YES	NO	NO	NO	YES	NO	YES	NO
US Cabin 4	1	NO	YES	YES	NO	NO	YES	NO	YES	NO
US Cabin Stock 1	4	YES	YES	YES	NO	YES	YES	NO	YES	NO
US Cabin Stock 2	1									
US Cabin Stock 3	1									
Walker Park	1									
Walker Park Stock 1	3									
Walker Park Stock 2	1									
Whatcom 1	1	YES	YES	YES	YES	YES	N/A	NO	NO	NO
Whatcom 2	1	YES	YES	YES	YES	YES	N/A	NO	NO	NO
Whatcom 3	1	YES	YES	YES	YES	YES	N/A	NO	NO	NO
Willow Lake	2									
PERCENT OF INVENTORIED SITES IN COMPLIANCE		50%	61%	55%	73%	73%	94%	29%	71%	10%

NUMBER OF CAMPSITES INVENTORIED: 116

TOTAL NUMBER OF WILDERNESS CAMPSITES: 213

TOTAL NUMBER OF WILDERNESS TENT PADS: 412

Section 9: Wilderness Management Training



North Cascades National Park Service Complex employed sixty-six full-time permanent, fourteen permanent less-than-full-time, and 111 temporary employees (102 FTE) in FY93. Thirty-four different employees received a total of nearly 3000 hours of wilderness training in 1993. This does not include law enforcement, wildland fire, emergency medical, blasting, and other skills needed by NPS personnel in wilderness.

Table 9-1: Wilderness Training in 1993

Course\Conference	Hours	Employees
National Interagency Wilderness Conference	10	1
Fire in Wilderness Conference	32	2
USFS Region 6 Wilderness Stewardship Course for Line Officers	80	2
CSU Correspondence Course "National Wilderness Preservation System"	80	1
CSU Correspondence Course "Management of the Wilderness Resource"	80	1
CSU Correspondence Course "Wilderness Management Planning"	80	1
CSU Correspondence Course "Management of Recreation Resources"	80	1
Wilderness Management Workshop - Yellowstone NP	24	1
WA. Backcountry Horsemen of America Conference	16	1
Field trip to USFS Coeur d'Alene and Plants of the Wild nurseries	32	1
Field trip to Glacier National Park to meet with Wilderness staff	8	2
NEPA Course	24	3
Backcountry Toilet Technology Workshop	24	2
Managing Search Function	80	2
Master of Leave No Trace	24	1
Seasonal Wilderness Ranger Training	80	22
Mountain Rescue Association Conference, Mt. Rainier	16	1
Historic Building Preservation	32	5
Rock Shaping, Glacier N.P.	40	2
Wilderness Stewardship for Line Managers	32	1
Trails Maintenance Workshop	32	1
TOTAL	2937	

Historic Structures Preservation Training

The trails division sponsored and taught a forty hour course on Historic Structure Preservation. It was funded by the Maintenance Workers Skills Training Fund. Eighty hours of hands on training given to improve the skills and abilities of Park Service employees who work on historic structures. Many historic structures, and much of the completed historic structure work in this Park, is in the Wilderness.

Managing the Search Function

The park sponsored a 40 hour "Managing the Search Function" class for thirty students from the NPS, Whatcom County sheriff's deputies, Skagit County deputies, members of Bellingham Search and Rescue and Skagit Search and Rescue. The National Association of Search and Rescue approved class was taught by Wilderness District Ranger Hugh Dougher. Through a series of lectures, discussions and practical exercises, the participants learned how to plan and manage searches in wilderness.

Section 10: Restoration and Revegetation



Restoration Management

Background

Although first proposed in 1892, it took a score of attempts over the next 75 years before North Cascades National Park was finally established in 1968. Most of what is now the Stephen Mather Wilderness was well protected by its inaccessibility and the ruggedness of its terrain. The lowland valleys and dense Pacific Northwest forests are resilient ecosystems that showed little lasting human impact.

In contrast to lowland forests, subalpine forest and alpine tundra are much more vulnerable. Subalpine and alpine plants evolved over thousands of years to survive cold, severe winds, deep snow, scorching heat, short growing seasons, and thin soils often lacking vital nutrients. When the park was established, many of its high mountain passes and sub-alpine meadows had been damaged or denuded by years of sheep grazing and unregulated recreational use. This causes changes in soil chemistry, altered microbial populations, increased erosion and causes a loss of nutrients. The cold dominated nature of these environments and associated short growing season slows natural recovery.

The Wilderness Act of 1993, defines wilderness as:

An area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which generally appear to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.

North Cascades's restoration program attempts to mitigate and repair human caused impacts to vegetation and soil. Some human impact and damage continues to occur every year despite the protective measures adopted by the *Wilderness Management Plan*. In 1993, the park wrote its first comprehensive *Revegetation Plan*. In 1994, impact monitoring, plant propagation, and site restoration were integrated into a restoration management program. The 1994 draft *Restoration Management Plan* provides a more detailed history of restoration management at the North Cascades National Park Service Complex, establishes standards and guidelines, and suggests future direction. The draft is currently undergoing peer review.

Plant communities

There are four broadly defined vegetation zones found on the west slope of the North Cascades. They are defined on the basis of altitude and the strong west-to-east precipitation gradient. From west to east across the Cascade crest they are the lowland forest, the montane forest, the subalpine forest, and the alpine tundra.

The lowland forest, which grows from sea level to 2950 feet, is dominated by western hemlock, western red cedar, and Douglas-fir. Pacific silver fir and mountain hemlock dominate the montane forest, which generally grows between elevations of 2950 feet and 4600 feet. Trees in the subalpine zone (4600-5740 feet) include subalpine fir, mountain hemlock, and Alaska yellow cedar. Contiguous forest cover ends around 5740 feet, but varies 500 feet, depending on the aspect of a particular site. Eleven subalpine communities are recognized in meadow, rawmark meadow, and colluvial slope meadow habitat. Alpine tundra vegetation above scrub line (5740 feet), is composed of grasses, sedges, composites and heaths.

On the east slope of the Complex, whitebark pine and subalpine larch are found in subalpine communities. At lower elevations grand fir, Douglas-fir, aspen and ponderosa pine are the dominant overstory species. Species that inhabit disturbed sites include red alder, willow, and fireweed.

Dominant trees on floodplains at low elevation and in wetland areas include big leaf maple, black cottonwood, alder and western red cedar.

Within the Ross Lake basin, drier plant communities are found than usually exist on the western slope of the Cascades, reflecting the drier conditions in the rainshadow of the Picket Range. These communities are particularly prevalent in rocky outcrops on the eastern shore of the lake. Dominant species within the drier communities include ponderosa pine, lodgepole pine, and aspen. On the western shore, wetter communities (including Douglas-fir and western hemlock) more typical of the western slope are found interspersed with lodgepole pine communities.

Restoration Options

Revegetation by itself cannot restore the complex plant and soil communities destroyed by human impact but it has proved to be an important tool for helping natural recovery to begin. The *Restoration Management Plan* identifies six primary restoration options: erosion control, natural revegetation, direct seeding, indigenous transplants, salvage and nursery propagation.

Erosion Control

Erosion control is widely used as a means of restoration on low elevation areas in the North Cascades. Locally collected rocks and timber are used to construct small siltation dams and water bars across eroding slopes. The sediment catches collect topsoil and seeds which germinate naturally.

Natural Revegetation

Closing an area with signs and conducting active patrols to guard against use has allowed the successful recovery of thirty impacted sites in NOCA's west side forest zone.

Natural revegetation can be accelerated by "layering" - inducing roots to form on a stem that is still attached to the parent plant. This technique has been extensively tested at North Cascades. Although it only works on certain plant species, it has proved to be an effective means of revegetating linear impacts such as social trails.

Direct Seeding

Direct seeding experiments at NOCA have met with variable success, dependent upon species, precipitation and other factors. *Spiraea sp.* (spirea) and *Phleum alpinum* (alpine timothy) have been successfully sown from seed. Initial experiments with *Carex* spp. (sedge) showed potential, but need refinement.

Indigenous Transplants

North Cascades has had success with on-site transplants in low elevation areas with a variety of ferns, *Cornus canadensis* (Canadian dogwood), *Streptopus* (twisted stalk), and *Abies amabilis* (silver fir). Mid-range elevation sites had lower survival rates, but were also deemed successful. Experience has shown that low growing, mat-forming, and rhizomatous species such as *Luetkea* and *Carex* as best suited for transplanting. A report by Nooney recommends against transplanting succulent, brittle and upright species, such as *Saxifraga* and the heathers, deep-rooted perennials such as *Lupinus*, and conifers.

A major problem with on-site transplanting is the generation of "holes" from where the plants were obtained. A report by Tunison noted greater recovery with fewer replacement problems in lower elevation areas. He also reported that holes made in *Luetkea pectinata* (partridgefoot) growing in the subalpine meadows at Boundary Camp had only 10-20 percent recovery after two years. The Millers observed slow recovery, and therefore recommend that plugs not be removed from small subalpine meadow areas such as Cascade Pass. Nooney describes techniques to minimize scars caused by plug removal.

Salvage

This technique is very similar to the indigenous transplants technique. However, rather than selectively removing small plugs and camouflaging the resulting scars, this method utilizes plants being displaced for trail or campsite projects, and plants severely threatened by forces such as trail erosion (such as when a trailbank is undercut). Obviously, the application of this technique is location and time dependent.

Nursery Propagation

Propagation, especially by cuttings, is the quickest manner of revegetating a site. It is also the most expensive. The propagation materials must be collected on-site at the proper time. Cuttings must be promptly transported to the greenhouse. The seedlings and cuttings must be cared for up to two years. The resulting plants require transport to the site by backpack, stock or helicopter, and considerable staff time is required for travel and transplanting.

Revegetation

History of Revegetation at North Cascades

Revegetation work began in NOCA soon after the Park's establishment in 1968. North Cascades first superintendent, Roger Contor, took immediate action to reverse years of neglect. In the summer of 1969, he arranged for Dr. Dale Thornburgh, an ecologist from Humboldt State University, to survey the impacts at Cascade Pass, the park's most highly visited sub-alpine area. Thornburgh's study identified forty-two hardened camping areas, scores of campfire scars, a maze of social trails, and severe impacts that could take decades or longer to recover naturally. Management recommendations and suggestions for revegetation were included in the report. One of the recommendations, the closure of the Pass to camping, was implemented in 1970. Contor hiked his division chiefs to a staff meeting at Cascade Pass and implemented a backcountry management program that included education, designated campsites, permit requirements, impact monitoring, plant propagation, and site restoration.

One of Contor's longest lasting legacies was to recruit and encourage two volunteer naturalists, Joe and Margaret Miller, to experiment with ways to revegetate the forty-two hardened camping areas, scores of campfire scars, and extensive network of social trails that were defacing the meadows and severely damaging the subalpine ecosystem of the area. In 1969, Joe and Margaret Millers found very little published research about the ecology or revegetation of sub-alpine plants. Their first experiment was to take cuttings of huckleberry, partridgefoot, heather and other plants from higher elevations and pack them out of the backcountry. These were transported to their own unheated greenhouse near Seattle. They experimented with different fertilizers, rooting mediums and hormones, light, heat and moisture conditions. Although their original results were inconsistent they demonstrated that subalpine plants propagated at sea-level could survive above 5,000 feet in elevation.

The Millers also experimented with transplanting plugs of vegetation from nearby sites. This strategy proved ineffective because the damaged roots of the plugs were slow to spread and the areas the plugs were taken from were slow to recover. They found that closing areas with frequent patrols to keep hikers out allowed huckleberry and partridgefoot to gain a foothold and natural recovery to begin. They had limited success with direct seeding. Their greenhouse propagation experiments were successful and they recommended the Park construct a propagating facility at Marblemount. In 1975 the Park built a 4 x 12 foot plastic covered cold-frame. This was followed in 1976 by a 4 x 10 foot plastic covered greenhouse. For the next decade, the Millers continued experimenting with natural revegetation in closed areas, taking cuttings and dividing them into multiple plants, and attempting to grow plants from seeds.

While Cascade Pass dominated early efforts, other high use or particularly sensitive areas - such as Whatcom Pass, Easy Pass, and Copper Ridge - received increasing attention. In the early 1970's research was expanded to other subalpine passes, with investigators unanimously recommending the closure of camping in these areas, as had already been implemented at Cascade Pass.

NOCA implemented a *Backcountry Management Plan* in the spring of 1974. This plan, which established a permit system with designated campsites, emphasized the replacement of highly-visible trailside camps with secluded, smaller camps not visible to each other or from the trail. All subalpine passes were closed to camping. Sites not selected for designated camping became candidates for revegetation. Beginning in 1976, revegetation efforts were expanded to impacted sites in the forest zones, with most revegetation accomplished by on-site transplanting.

The arrival of backcountry area ranger Bill Lester to North Cascades in 1978 infused the program with new energy and direction. He was the catalyst who combined Contor's visionary ideas and the Millers research with a talent for cutting through inertia and redtape to mobilize resources and support. The revegetation program found enterprising, innovative and efficient ways to keep a program growing on a shoestring budget. Lester solicited contracts to grow plants for other agencies and parks, set-up a successful donation account and established partnerships with the Mountaineers, Washington Native Plant Society, and other local conservation groups. The Student Conservation Association became a special partner who, over the past fourteen years, has provided eighty resource assistants and over 40,000 hours of labor to the wilderness of North Cascades. Resource assistants are fully integrated into the staff and over thirty have gone on to become NPS employees.

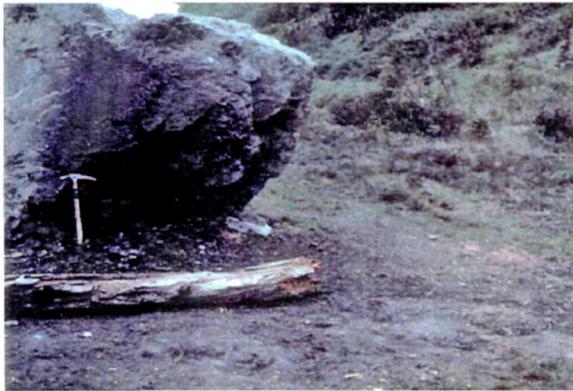
Bill Lester and his wife Kathy had the rare gift of a "green thumb." Plants received meticulous care. In 1986, they achieved the first success in germinating leutkea and spirea from seeds. The breakthrough technique, discovered largely by trial and error, was to sew seeds on the soil surface where they were exposed to sunlight and to provide high humidity and high heat (30 C). In the first two years, 20,000 plants were successfully propagated. In addition to being more cost efficient, growing plants from seeds produced better genetic diversity than was possible through cuttings and division.



Horses hitched to trees can damage roots, cause erosion and kill the tree.



Poor trail location and drainage causing multiple trails and severe erosion.



Long term impact: altered soil chemistry and exposed mineral soil prevents natural recovery.



Fire scars and bare ground mar a pristine lake.



Multiple social trails and revegetation disturbances at a sub-alpine pass.



Cascades Pass in 1977 with multiple social trails and disturbed vegetation.



Cascades Pass in 1989; rockwork has concentrated use and vegetation is recovering.



After hardening and marking a new trail, social trails are restored.



Closing a sensitive area to camping allows recovery to succeed.



Jute netting used to stabilize soils and heal roots damaged by horses.



Ranger planting "plugs" of Carex to recover bare ground.

In 1980 the program was further expanded with a YACC-constructed 20 x 40 foot (800 sq. ft.) propagating greenhouse that could potentially support the annual production of 5000 plants. Seasonal rangers and Student Conservation Association volunteers provided necessary staffing for the propagation program. With the construction of the greenhouse, NOCA's revegetation program began to focus more on the off-site propagation of plants, especially for Cascade Pass.

The appointment of John Reynolds as Superintendent in 1984 provided new direction for wilderness management and revegetation. Congress designated 634,614 acres of North Cascades as wilderness in 1988. The entire wilderness was placed under one district. North Cascades became the first NPS area to have an approved wilderness management plan based on the Limits of Acceptable Change. Revegetation was integrated into a comprehensive wilderness management program that includes impact monitoring, computerized backcountry permits, composting toilets, upgrading trail maintenance, prescribed natural fire, an emphasis on education and information, and effective patrols by backcountry rangers with responsibility for specific high impact areas.

Between 1981 and 1987 an estimated 55,000 plants were propagated at Marblemount, and outplanted to Cascade Pass. Of the forty-two impacted sites which had been originally identified by Thornburgh, twenty were fully revegetated, and all but three were 50% revegetated. Annual reports for the first half of the 1980's indicate the District's revegetation efforts were supported by a Revegetation Crew consisting of one seasonal ranger and two to five SCA volunteers yearly. While Cascade Pass dominated early efforts, other high use or particularly sensitive areas - such as Whatcom Pass, Easy Pass, and Copper Ridge - received increasing attention. Annual reports for the years 1979-1987 discuss the techniques and funding sources used for these efforts.

After twenty-five years, the Millers are still working in the backcountry of North Cascades. Because of their pioneering work 100,000 sub-alpine plants have been successfully transplanted and many denuded sites have been transformed into living meadows. Hikers to Cascade Pass, Monogram Lake, Whatcom Pass, Park Creek Pass, 10-Mile camp, and other locations have an opportunity for a quality wilderness experience "where the impact of man's work is substantially unnoticeable." The Millers work has influenced the rehabilitation of thousands of acres in parks and forests throughout the Pacific Northwest.

Prioritization of Revegetation Projects

Because of the wide variety of types, sizes and severity of impacts existing in the Stephen Mather Wilderness, and with finite resources available for restoration efforts, it is necessary to prioritize potential projects. Priorities are established by the following process:

Ecological Impact/Cumulative Effects

Impacts where the erosion potential is likely to affect water resources, that are consistently worsening, or that otherwise are susceptible to future degradation receive priority attention. Non-designated way trails on steep slopes are common examples.

Visibility

Visibility influences priority. The greater the visibility of an impact, the greater the chances are that it will attract ongoing use. Thus, impacts visible from maintained trails receive higher priority than impacts not visible from maintained trails.

Size

The larger the impact, the higher the priority.

Administrative Concerns

This refers to a variety of factors that affect the priority placement of restoration projects. Examples:

- As opportunities occur, restoration work is coordinated with trail building, maintenance, or re-routes, so as to salvage plants and soil. Coordination with trail crew personnel to maximize these opportunities is on-going.
- Special funding opportunities increase priority.
- The proximity of a lower priority project to on-going higher priority work may make it cost-effective to revegetate both impacts simultaneously.

Alpine and subalpine zone impacts take priority over forest zone impacts. Alpine and subalpine areas are more easily impacted due to a predominance of vegetation types that are easily damaged - particularly *Cassiope mertensiana* (white heather), *Phyllodoce empetriformis* (red heather), *Vaccinium sp.* (huckleberry), and *Veratrum viride* (hellebore). Subalpine areas also have a short growing season of several months and shallow, easily-eroded soil, leaving them less likely to revegetate naturally after impact.

Forest zone impacts are more able to heal naturally if efforts are made to prevent further impact.

The location, size, and complexity of projects influence the logistics needed to support nursery stock outplanting. Remoteness, available options for transporting materials, amount of materials, hardiness of plants, predicted weather, and availability of staff and volunteers must be considered. Emphasis is placed on small work parties, and transporting revegetation materials and workers without helicopter support, whenever possible to meet minimum tool guidelines. This means that sufficient time must be programmed for the project, so that plants are not lost to hurried treatment in the field.

Revegetation Policy

Recreation-related impacts exceeding the standards of the *Wilderness Management Plan* are not acceptable. The Park strives to restore areas affected by human use, with respect to maintaining ecological systems that were in place before disturbance.

The policy for the Stephen Mather Wilderness is to replace lost vegetation with a mix of individual species closely representing the immediately surrounding community. In areas that have suffered or are threatened with severe plant and soil loss, the most desirable objective is to restore with a sampling of species closely representing the original community. Where this is not possible due to difficulties in growing hard-to-propagate species, sites will be revegetated with resilient species having high transplant survival rates. In this latter situation, the selected species should be sub-climax to the desired community, so that natural succession can occur after site stabilization. Revegetation with species different than those originally inhabiting the site (or currently surrounding it) is avoided except where there is no feasible alternative.

Where it is necessary to revegetate with species not native to the immediate site, a recommended choice is *Luetkea*, a natural invading alpine species. Research in the Park has determined *Luetkea* to be the pioneer species on bare compacted soils. *Luetkea* has a broad ecological tolerance range, and a relatively rapid rate of reproduction by runners. For loose disturbed soils, *Carex spectabilis* has been found to be the dominant pioneer species.

Genetic Integrity

Maintaining genetic integrity of plant stock and protecting against exotic species are the highest priorities of restoration efforts. To ensure genetic integrity:

- Plant materials for restoration projects are collected only from areas within visual proximity of project sites.
- Seeds and cuttings are collected from as many widely separated individuals as possible, so as to minimize any shift in the proportions of different genotypes relative to the native population.
- At time of collection all material is tagged with date, species, elevation, aspect, associated vegetation, distance and compass bearing from project site, project name, and name of collector.
- Materials remain tagged through all propagation steps.

Exotic Plants

To prevent the introduction of exotic species:

- Except for soil needed to support the roots of nursery stock being transplanted, the transportation into the wilderness of non-sterilized dirt is avoided to prevent the introduction of exotic organisms. This does not include peat moss.
- Only soils and other propagation supplies having minimal risk of containing exotic plants is used in the greenhouse operation.
- All plants are individually inspected for foreign species and seeds before leaving the greenhouse facility for transportation to project sites.
- Inspection for exotic species is part of the annual evaluation of project sites.
- All staff are trained to recognize the various species used for restoration projects and directed to report any strange species observed at these sites.
- Sterilized soil is recommended for future projects.

Miller Greenhouse

In 1992 NOCA received NRPP monies to construct a 1,728 sq. ft. metal frame greenhouse with rigid plastic panels. It is temperature controlled, with gas heaters, fans, and evaporative cooling. On Memorial Day 1993, Park Superintendent Bill Paleck recognized the Miller's long and valuable service to the NPS by making them honorary park rangers and naming the greenhouse in their honor.

Growing Beds

Growing beds are used to harden or overwinter plants. They contain wood chips, sawdust, or soil, which are used to insulate overwintering plants. In the spring of 1994 twelve 15 x 5 foot growing beds, framed with pressure treated 2 x 8 inch boards, were constructed adjacent to the Joe and Margaret Miller Greenhouse. These new growing beds replace the beds located adjacent to the old greenhouse. The older beds are framed with logs and creosote treated timbers. These older beds will be dismantled.

Recordkeeping

A logbook is maintained for all greenhouse work. Each time any work is done, an entry should be made, even if it is only a half hour of work. The logbook is divided into three sections: daily work entries, chemical log, and work hours.

Photoperiodic Lighting

Increasing photoperiod by artificial lighting is essential for high elevation species being propagated in greenhouses. Increased photoperiod accelerates development by preventing cessation of stem

elongation, and allows plants which otherwise would require multiple years of nursery care, to be propagated and outplanted in one season. For example, at least twelve hours of light every twenty-four hours is needed for *Carex*.

Photoperiodic lighting is being planned for the Miller Greenhouse. There are three lighting methods that are available to prevent dormancy induction: night-break lighting, daylength extension lighting, and all-night lighting. In night-break lighting, lights are turned on for a few hours in the middle of the night. Daylength extension lighting involves supplying two to four hours of artificial light after dusk or before dawn. Under consideration is a centrally mounted high-pressure sodium lamp in an oscillating mirror. This system produces intermittent lighting by oscillating the mirror back and forth across the growing benches and is energy efficient.

Decreasing Photoperiod

Control of photoperiod is the predominant trigger that causes tree seedlings to cease height growth and set a terminal bud. This hardening prepares the plants for the stresses of winter and/or outplanting. Hardening can be initiated by simply removing artificial lighting at least several weeks prior to the plants being transferred from the greenhouse. The natural daylight of late summer and fall will trigger the hardening process.

Temperature

Research suggests that the optimum temperature for the greenhouse cultivation of alpine plants is in the range of 68 to 77 degrees F., and is particularly productive if provided on a diurnal variance of 7.2 to 9 degrees F.

Duff

Because of the risk of transporting pathogens, adding duff to growing media at the nursery is only practiced either when believed to be critical to the success of the propagation effort, or under experimental conditions. When used, duff will originate from the same immediate area as the propagation material.

Otherwise, inoculation of plants shall occur at restoration sites, by native duff being added to the soil during outplanting. One procedure recommended in the literature is to inoculate the planting holes of transplants using soil and fine roots from under nearby healthy plants. It is important that the soil be from the upper layer, as this contains the most fine roots. Care must be taken to avoid critical damage to the source plants.

Erosion Control Blankets

Experience at North Cascades has found aspen fiber blankets to be superior to coconut fiber products for revegetation. Coconut fiber is denser, heavier and not as biodegradable. Coconut blankets tended to slip downslope, whereas the aspen fibre barbs clung to the soil. Millar indicated that germinating plants had difficulty penetrating the coconut blankets, a problem that did not exist where aspen blankets were used. On past revegetation projects Aspen has been found to decay much quicker. Jute netting has been known to remain visible for over seven years.

Use of Mycorrhizal Fungi

Some researchers state that it is necessary to introduce mycorrhizae after severe disturbance. Campsite impacts with eroded, compacted, and sterilized-by-campfire soils meet his definition of severely disturbed. Good non-mycorrhizal seedlings can be grown in the controlled conditions of the greenhouse. Even so, mycorrhizal seedlings in greenhouses will frequently be healthier and more robust than non-mycorrhizal ones. In the humid Pacific Northwest, seedlings in greenhouses may become mycorrhizal by windborne inoculation, or become quickly inoculated once outplanted.

Many fungi form mycorrhizae with a variety of plant species. These mycorrhizae - which are symbiotic associations with plant roots - benefit the host plant by allowing increased nutrient uptake, drought resistance, disease protection, and increased outplanting performance. Mycorrhizae can also help prevent damping off and root rot. Mycorrhizal fungi can be inoculated into growing media by the addition of forest duff. However, there is an element of risk involved, because the duff can contain inoculum of phytopathological fungi, nematodes, insects, and other pests.

Growth Hormones - Growth hormones are essential to the successful propagation of a number of subalpine species, and may be used.

Fertilizer - Fertilizer is also essential, and may be used. To avoid the introduction of exotic species, manure will not be used.

Pesticides and Herbicides - Pesticides and herbicides will not be used. Davis (1991) describes non-toxic control techniques for the more common rodent and insect problems.

Sanitation

A recommended disinfectant for flats, floors, walls benches, and tools is a solution of commercial bleach diluted 10:1 with water.

Future Plans

In 1993 a landscape map was developed for the Joe and Margaret Miller Greenhouse area as the initial step in moving and expanding the native plant nursery. Deciduous trees have been planted and a shade structure is being designed to provide shade needed for growing newly transplanted and young plants that cannot take full spring or summer sun. The nursery will include propagation beds, public demonstration beds and interpretive displays, sheds and work areas.

Research Needs

The top staffing priority for Resource Management is to hire a research grade plant ecologist. Research priorities for revegetation in the North Cascades are:

- Improved techniques for the on-site propagation of plants from seed, and the greenhouse propagation of *Phyllodoce empetriformis* and *Cassiope mertensiana* (heather species).
- Experimentation to improve the survival rate of hard-to-propagate species such as the heathers, and development of techniques to propagate additional species such as subalpine fir and mountain hemlock are also needed.
- Comprehensive review of the Millers' experiences and reports to identify recommendations and other information that might be helpful in charting future direction.
- Experimentation with techniques to restore alpine and forest impacts.

Revegetation Species

The park has had success with successfully transplanting the following species:

From cuttings:

Aruncus sylvester - goats beard
Arctostaphylos uva-ursi - kinnikinnick
Cassiope mertensiana - heather
Heuchera sp. - alumroot
Linnaea borealis - twinflower
Luetkea pectinata - partridgefoot
Phyllodoce empetriformis - heather
Sibbaldia procumbens - sibbaldia
Spiraea densiflora - spirea
Vaccinium spp. - huckleberry

By division:

Carex illota - sedge
Carex nigricans - sedge
Carex spectabilis - sedge

From seeds:

Antennaria sp. - pussytoes
Arctostaphylos uva-ursi - kinnikinnick
Carex illota - sedge
Carex nigricans - sedge
Carex spectabilis - sedge
Linnaea borealis - twinflower
Luetkea pectinata - partridgefoot
Pachistima myrsinites - Oregon box
Potentilla sp. - cinquefoil
Spiraea densiflora - spirea

Impact Monitoring

Background

Impact monitoring is a critical adjunct to site restoration: monitoring is necessary both to establish restoration project priorities, and to measure the long-term success of these projects. Impact monitoring at NOCA dates back to the late-1970's, when the park began to measure changes in levels of impact to vegetation at selected sites. Over the next fifteen years, baseline and monitoring data for campsites and other social impacts was gathered using a line-intercept transect. In 1993 the Park contracted with the University of Idaho to analyze this data, and preliminary results are expected by the end of 1994.

A project to develop a wilderness-wide inventory of recreation-related impacts was also begun in 1993. Since inception, wilderness and climbing rangers have identified, mapped, and documented approximately 100 such impacts. These impacts range from fire rings to large damaged areas. The objectives of this project are to identify and prioritize future restoration projects, to help District staff recommend visitor management actions to minimize additional impacts, and to identify trends in impact levels.

Impact monitoring and restoration are closely associated: impact monitoring studies provide important data for establishing restoration project priorities, and are necessary for measuring the long-term success of these projects. The Wilderness Management Plan establishes the level of acceptable change for campsite impacts as a 25% increase over the original constructed campsite size or baseline data. The limitation of this LAC is that it doesn't consider the amount of bare area that is unavoidable, especially as related to party size.

A line-intercept transect method derived from Moorhead and Schreiner has been used to obtain baseline and monitoring data for 143 of the 172 designated wilderness hiker campsites, and two of the forty-three designated wilderness stock campsites. Similar data exist for nine of the 133 backcountry (non-wilderness) campsites, and for 112 other impacts. These 112 impacts are mainly old campsites located in the Trailed/Established Camps opportunity class zone.

Future impact monitoring needs include continuing the development of an inventory of all wilderness recreation-related impacts; developing new LAC campsite standards for bare ground that realistically reflect party size limits; establishing baseline data for all newly constructed or renovated campsites immediately upon project completion; obtaining baseline data for those designated wilderness campsites for which such data does not exist, and monitoring designated campsites for LAC standards on a five year cycle.

Study of Long-Term Campsite Impact Monitoring Data

Between 1977 and 1992 backcountry/wilderness managers at NOCA collected data on damage to vegetative cover at about 270 backcountry sites. This data was collected in a fairly standard manner, although the methodology was occasionally refined. However, little was known about the preciseness and accuracy of the data. A major step to correct this deficiency occurred in 1993 when NOCA contracted with the University of Idaho to analyze the data. The two-year project was initiated as a graduate thesis project by Dean Gettinger.

The objectives of the research are to:

- Organize the existing data into a computerized database and determine consistency and validity of data.
- Analyze data to identify trends in campsite impacts.
- Recommend the minimum frequency of monitoring needed to detect impacts which have exceeded Limits of Acceptable Change (LAC) standards (or are about to) outlined in the Park's Wilderness Management Plan, and identify sites which have exceeded the LAC standard.
- Review the methods of the current monitoring program and make recommendations for improving the monitoring program's ability to detect changes in campsite conditions within existing time/budget constraints, and identify how future data collected using new methods can be integrated with pas data.
- Review the backcountry permit system and assess its ability to provide information suitable for integration with the campsite monitoring program.
- Make recommendations for revisions to the backcountry permit system to improve its usefulness in providing data to enhance the campsite monitoring program.

Preliminary results and conclusions of the research are expected by the end of 1994 and his thesis, *An Evaluation of Long-Term Wilderness Campsite Impact Monitoring Data at the North Cascades National Park Service Complex*, in 1995.

Impact Monitoring Project

In 1993, a *Crosscountry Impact Inventory Manual* was written to establish procedures for measuring impacts. Information on the size and type of impact, cause of impact, distance from maintained trail or designated campsite, elevation, vegetation types, administrative considerations, and recommendations are recorded for every site that is evaluated. Each site is rated as recovering, stable, or deteriorating and a restoration priority of low, moderate, or high assigned.

Restoration Plans

Once an impact has been selected for possible restoration a work plan is prepared. The development and review of the plan shall be done in consultation with Trails, Resource Management, and Archeology. Upon approval, the project shall be submitted for NPS, SEEC, NOVA, or other funding. Work plans shall be approved before plant propagation material is collected, or other field work is initiated. A *Restoration Work Plan* includes the following:

Background Information

- Problem statement describing the impact.
- A discussion of the known history and cause of the impact.
- A discussion of the alternatives considered, including justification for the selected alternative.
- Priority assessment.
- Objective of the project (ie. "Completely revegetate campsite").
- Name of project coordinator.

Maps

- The location of the impact is recorded on a photocopied topographic map.
- The extent of the impact is recorded on a detailed hand-drawn map of the site. The map includes, as a minimum, a sketch of the site, photo point location(s), scale (if any), and an arrow pointing to magnetic north.
- For camping impacts, the size of the disturbed area is measured and mapped.
- A second sketch is prepared to show those portions of the impact to be revegetated. Any portions not to be revegetated are identified and alternative management actions considered.

Photographs

- Color slide (and sometimes black and white print) photographs are taken of each site. The photographer keeps a log of the frame number and description of the photograph. The photographer also indicates on a sketch map the location from which each photograph was taken, and the direction of the camera.

Impact Data

- Inventory and impact parameters are documented using line-intercept transect or other methods, as appropriate to the project.

Physical Conditions

- Floristic composition (overstory and understory trees, shrubs, and herbaceous plants), ecological zone and stage of succession, macro and micro climate, soil conditions (moisture retention capability, organic matter, nutrient levels, compaction, drainage), exposure to sun (aspect), wind, amount and seasonal distribution of precipitation, amount of shade, water availability for supplemental watering, and availability of plant or seed sources are evaluated and documented as appropriate.
- Soil pH should be measured using a pocket soil test kit and compared with the pH requirements of the species proposed for the site.

Details of Work

- An estimate is made of the required number of plants by species, suggested plant density, proposed schedule, soil conditioning needs, materials list and sources, methods of transport to be used, estimated costs, personnel needs, and recommended management actions to prevent recurrence.

Background

- Project background, including location, description, use history, and current permitting situation for the camp or crosscountry zone.
- Funding information, including possible funding sources and estimated cost.
- Restoration options.
- Actual work plan, including what shall be done, who shall do it, and the time frame needed.
- Special concerns, such as protection of archeological resources, presence of sensitive or exotic species, and safety recommendations.

Compliance

- The completed draft work plan is received by the Wilderness District Ranger, and then routed to the Trails Foreman, a Resource Management Specialist, and the Park Archeologist. Their comments are incorporated into a final draft which is approved by the Wilderness District Ranger, Trails Foreman, Resource Management Specialist, and Archeologist before routing to the Superintendent for final approval.

Follow-up Monitoring

Each completed restoration project shall be inspected at least yearly for the first five years. Each inspection will be documented by a report describing the condition at the site, changes since project completion, and any additional work performed. Photographs are taken as appropriate.

Each restoration project is then added to the impact inventory to be fully evaluated every three to five years. The current *Wilderness Management Plan* recommends trail zone sites be evaluated every three years, and crosscountry zone sites every five years. The evaluation will be documented by a narrative describing conditions, especially as related to the success of the project. Sketches will be prepared, and photographs taken to replicate the photographs of the original Restoration Plan. The extent of the existing impacted area will be measured and mapped.

Section 11: Needs for a Fully-Functional Wilderness Program



Table 11-1 is the needs for a fully functional wilderness program prepared for the Annual Report to Congress on Wilderness Management for 1993.

Table 11-1: Needs for a Fully Functional Wilderness Program

Area of Wilderness Program	Currently \$(1000s) FTEs	Additional Needed \$(1000s) FTEs	Needs Documented in? (i.e. RMP, WMP)		
Wilderness Management Planning	54.5	0.6	55.5	2.2	PNR Needs *1
Develop Resource Baseline and Monitor Wilderness Resources	120	3.6	861	18.8	RMP *2
Research	2300	.8	1469	16	RMP *2
Visitor Management and Resource Protection	130	3.7	100	2.8	PNR Needs *1
Resource Restoration	82.5	2.2	287	7.6	RMP *2
Maintenance	209	4.5	352	9.5	MMS *3
Wilderness Interpretation and Education	153	6.4	127	4.2	Stat. for Interp *4 PNR Needs *1
Training	1	0.2	7.5	0.3	PNR Needs *1
Total	980	21.4	3259	61.40	

*1 Pacific Northwest Region Needs for a Fully Functional Wilderness Program

*2 NOCA Resource Management Plan

*3 NOCA Maintenance Management System

*4 North Cascades Annual Statement for Interpretation

Table 11-2 is the special funding requests that have been submitted to the Pacific Northwest Region and Washington for FY95.

Table 11-2: Wilderness Related Special Funding Requests for FY95

Priority	FTE	Current Year \$	Total Year \$	94 Project Submissions
NS-1	0.2	6	18	Glacier Monitoring
NS-2	1.2	30	120	Amphibian Distribution and Inventory
NS-3	0.8	7	35	Avian Productivity and Survivorship
NS-4	0.8	12	62	Stream/Riparian Habitat Inventory and Monitoring
NR-1	0.4	15	40	Revise Wilderness Management Plan
NR-2	0.5	12	36	Salmon Spawning Channel Assessment
NR-3	0.4	10	44	Management of Exotic Plants
NR-4	0.5	12	12	Water Quality and Fisheries Data Backlog
NR-5	0.5	12	47	Bull Trout Biology
NR-6	0.3	7.5	55.7	Planning and Compliance
CC-4	0.8	20	100	Preserve Historic Backcountry Lookouts, Cabins and Shelters
CR-6	1.2	44	164	Improve Basic Documentation of Historic Structures
AQ-1	0.3	8	32	Ozone Monitoring
AQ-2	0.1	3	30	Operating of NADP Site
AQ-3	0.6	15	30	Cloud Water Deposition
AQ-4	1.2	30	30	Air Quality Modeling - NOCA Complex
AQ-5	1.2	30	60	Monitor Biological Effects of Air Pollution
AQ-6	0	0	260	Install IMPROVE Air Quality Monitoring System
AQ-7	0.2	0	20	Visibility Monitoring - NOCA Complex
RR-7	3.0	92	340	Replace Unsafe Trail Bridges
RR-13	1.0	50	500	Survey/Design Trails/Bridge/Camp Compliance
RR-14	1.0	50	500	Rehabilitate/Upgrade Wilderness Camps
RR-23	1.5	0	150	Trail Reconstruction - Parkwide
RR-26	1.0	0	50	Repair/Rehabilitate Bridge Creek Cabin and Corrals
RR-29	1.5	0	250	Rehabilitate/Revegetate Trails
EH-3	1.0	73	73	Replace Lightning Creek Floating House Unit
EH-8	0.31	0	385	Replace Inadequate Seasonal Housing in Stehekin

Priority	FTE	Current Year \$	Total Year \$	94 Project Submissions
EH-9	0.75	0	200	Rehabilitate Housing - Marblemount
EH-10	0.5	0	250	Construct New Seasonal Housing at Marblemount
LI-9	0.2	0	300	STE Boundary Survey
LI-13	3.2	0	723	Construct Trails - Skagit District
RC-2	3.5	150	750	Cyclic Trail Maintenance Parkwide
RC-6	0	12	16	Rehab Interpretive Relief Maps
RC-8	0.20	9	90	Maintain Interpretive Displays
RC-11	0	0	6	Correct Visitor Center Wall Map
RC-12	0	12	24	Replace Obsolete Info. Displays at Stehekin
RC-13	0	9	90	Maintain Visitor Center AV Programs

NS = Natural Science Regional Program

NR = Natural Resources Regional Program

CC = Cultural Cyclic

CR = Cultural Resources Preservation Program

AQ = Air Quality

RR = Repair-Rehabilitation

EH = Employee Housing

LI = Line Item Construction

RC = Regular Cyclic

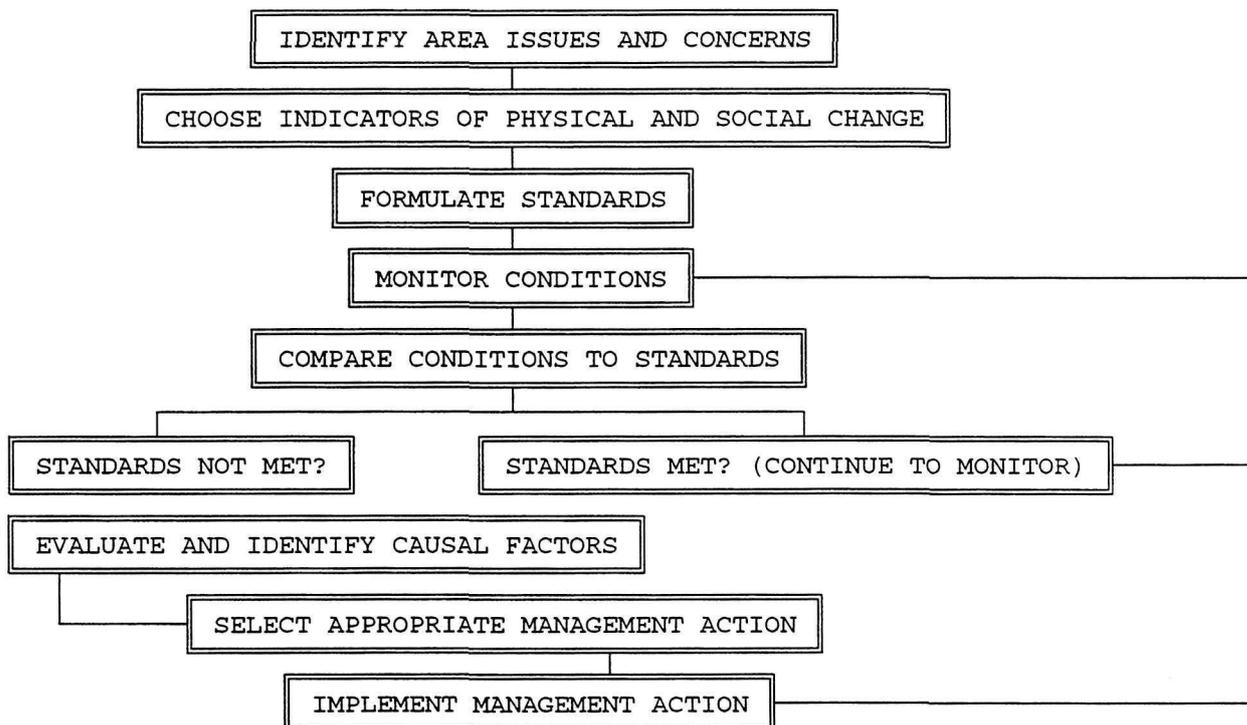
The park submitted a proposal for "prototype long-term ecological monitoring of lakes and waters." If funded, this extensive proposal would allow the systematic monitoring of numerous components of aquatic ecosystems at a variety of spatial scales over five years.

Revision of the Wilderness Management Plan

Rewriting the park's Wilderness Management Plan is a top Natural Resource priority. At the time the Wilderness Plan was written, the park had no GIS, there was little baseline inventory and monitoring data, and the plan received only limited public involvement.

The revision process is expected to begin in 1995 or 1996. The revision will include NEPA compliance, full public involvement and will follow a Limits of Acceptable Change model which has nine steps:

Table 11-3: The Limits of Acceptable Change Process



Adapted from Stankey, et al., 1985

Step 1: Identify issues, concerns, and special values.

This step identifies the primary concerns management should focus on. The role of the area in a regional and national context should be explored.

Step 2: Define and describe opportunity classes

Opportunity classes describe the setting visitors can expect to find in the wilderness. Defining opportunity classes ensures diversity within wilderness and helps describe future condition. This spectrum approach accommodates varying definitions of the wilderness experience.

Step 3: Select indicators of resource and social conditions

Indicators are specific elements of the wilderness setting that change in response to human activity. Examples are bare ground at campsites, lichen species, composition and encounters between groups. Indicators provide quantifiable documentation of quality of health of the area.

Step 4: Inventory existing resource and social conditions

The inventory establishes the range of conditions that currently exists in the wilderness. The inventory is guided by the indicators selected in the previous step.

Step 5: Specify standards for resource and social indicators

In this step the limits of acceptable change are quantified into measurable objectives. Standards specify the amount of impact we are willing to tolerate in each opportunity class. Standards are very important because they become the triggers for corrective management action.

Step 6: Identify alternative opportunity class allocations

In this step alternative ways of managing the wilderness are identified in terms of the proportion of the wilderness devoted to different opportunity classes.

Step 7: Identify management actions for each alternative

This step identifies the management actions that would be necessary to bring the existing conditions up to standard under each alternative. This helps display the costs associated with each alternative.

Step 8: Evaluate and select a preferred alternative

This step displays the benefits and costs associated with each alternative so that the decision-maker can select an alternative.

Step 9: Implement actions and monitor conditions

A wilderness action plan is prepared based on the selected alternative which outlines what needs to be done to bring existing conditions up to standard, who will do each action, when it will be done, and how much will it cost. A monitoring plan is an important part of the action plan, so changes can be tracked over time.

Potential LAC Indicators

Indicators for measuring human impact that may be utilized:

- Average party size
- Parties contacted per hour of hiking
- Party compliance with Park regulations
- Pieces of litter collected per mile of hiking
- Incidents of toilet paper or human feces observed per mile of hiking
- Illegal firerings dismantled per mile of hiking
- Number of aircraft heard per hour
- Minutes of aircraft noise heard per hour
- Complaints per party (related to trail and camp conditions, policies, and other items under the control of management)
- Compliments per party (related to trail and camp conditions, policies, and other items under the control of management)
- Food storage, as expressed by the ratio of camper parties observed practicing proper food storage compared with camper parties observed not practicing proper food storage

Other Data with Possible LAC Application

- Accidents per 100,000 climbers
- Fatalities per 100,000 climbers
- Party size
- Permit compliance: 96%
- Observed regulation compliance: 92%
- Level of use compared with theoretical capacity
 - Hiker camps: 21%
 - Stock camps: 6%
 - Crosscountry zones: 2%.

Public Involvement

The revision of the Wilderness Management Plan will follow the Limits of Acceptable Change process which includes public involvement at all phases of the planning effort including an opportunity for participating in field trips, attending public meetings, mailed correspondence and one-on-one contacts with the North Cascades Staff.

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