U.S. FOREST SERVICE WILDERNESS MANAGEMENT: Problems and Management Methods of Four Wilderness Areas in the Pacific Northwest

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A RESEARCH PAPER
Submitted to
THE DEPARTMENT OF GEOGRAPHY
OREGON STATE UNIVERSITY

In partial fulfillment of
the requirements for the degree of
MASTER OF SCIENCE

May 1978

Directed by
Dr. James R. Pease

ACKNOWLEDGEMENTS

The completion of this research was possible because of the cooperation and support of many individuals. I am grateful to Mr. Roger Stamy, Wallowa-Whitman National Forest Supervisor's Office, and to the wilderness managers of the Bear-Sleds Ranger District, for their initial encouragement and continual support of this research. I would like to express my appreciation to Mr. Tony Skufca, Mr. Dalton Du Lac, and the recreation staff of the Forest Service Regional Office for their cooperation and hearty support throughout the study. The wilderness managers and administrators of Mt. Baker-Snoqualmie, Gifford Pinchot, Willamette, Wenatchee, and Wallowa-Whitman National Forests deserve a special note of thanks for participating in the study. I would like to express my respect for the integrity and candor of all of these men as public land managers. I gratefully acknowledge the National Forests which contributed to the financial support of this project. The counsel of Dr. George H. Stankey, of the the U.S. Forest Service Intermountain Forest and Range Experiment Station, is greatly appreciated.

I would like to express my gratitude to Dr. James R. Pease for his valuable guidance and support throughout this research. Suggestions received from Drs. Mary Lee Nolan, Richard A. Meganck, and Robert E. Frenkel are gratefully acknowledged. I would also like to thank Dr. A. Jon Kimerling, Director of the Department of Geography Cartographic Services, for his cartographic assistance, and Mr. James Eggert for his excellent preparation of the individual study area maps.

Finally, I wish to thank my friends whose camaraderie provided moral support to my efforts. In particular, I wish to thank Mr. Paul E. Donheffner, who also provided helpful suggestions and assistance with this study.

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U.S. FOREST SERVICE WILDERNESS MANAGEMENT:

Problems and Management Methods of Four Wilderness Areas in the Pacific Northwest

ABSTRACT. Increasing wilderness use, and the uneven distribution of use within wilderness areas, have contributed to management problems. Problems associated with some heavily visited areas are in conflict with the intent of the Wilderness Act of 1964. One of the constraints hindering optimal management has been the decentralized nature of the U.S. Forest Service which has made it difficult for managers to be aware of the problems and management methods of other wilderness areas. In this study, the problems and management methods of four wilderness areas in the Pacific Northwest have been identified. The primary problems of the four areas have been classified into two categories: environmental degradation, involving camping areas and trails; and administrative problems. Although study area managers did not have a common definition of unacceptable physical or social impact they all agreed that environmental degradation was occurring in some portions of the wilderness. The management approaches which have been utilized to mitigate these problems represent techniques in visitor management, resource management, or administrative methods. Techniques in visitor management, involving regulation and education, have been implemented the most frequently. It is difficult to measure the individual effectiveness of a technique because of the interrelated nature of all techniques. Managers felt mitigation was the most effective when complementary techniques from different categories were implemented concurrently.

INTRODUCTION

Background

The recreational use of National Forest Wilderness and Primitive Areas has increased an average of ten percent annually between the end of World War II and 1975.[1] By 1977, this use represented over eight million visitor-days.[2] In Oregon and Washington, use of National Forest Wilderness and Primitive Areas has increased an average of eight percent annually since 1966. In 1977, this use represented over 345,000 visitor-days, which is four percent of the national total.[3]

The spatial and temporal distribution of use throughout wilderness areas is highly skewed.[4] In many areas, the temporal distribution is concentrated during a short summer season lasting less than three months. Within this season, weekends and holidays tend to receive peak use, particularly in those areas which are closely located to urban centers (Fig. 1).

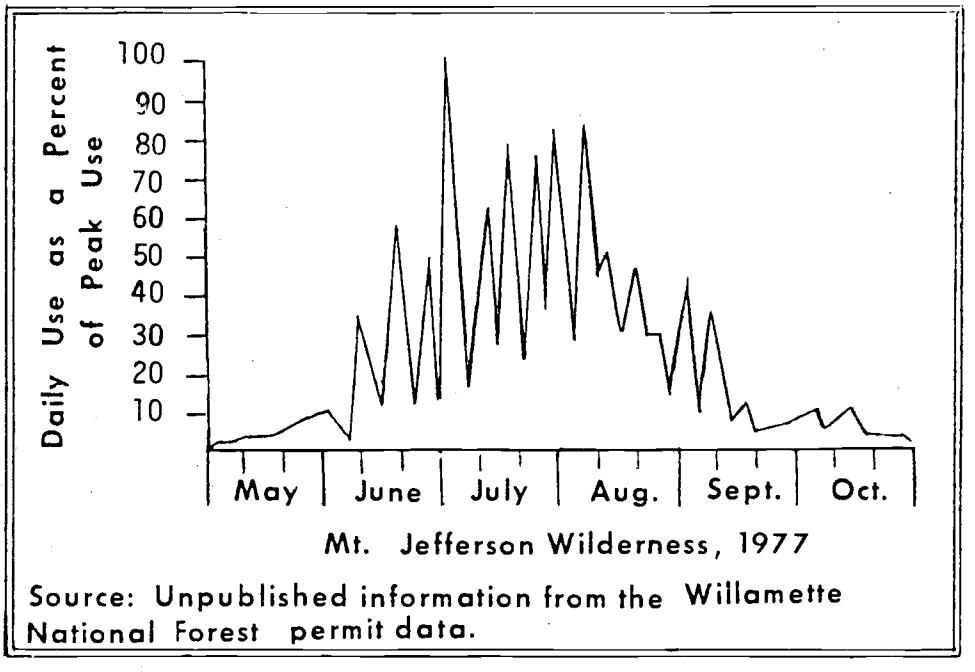


Fig. 1. Daily use is shown as a percent of peak use. The peaks depict the weekend and holiday popularity of Mt. Jefferson Wilderness.

The spatial patterns of use indicate that specific portions of a wilderness area receive the majority of use.[5] Collectively, these factors have serious effects on visitor distribution. For example, in the Eagle Cap Wilderness, Wallowa-Whitman National Forest, over seventy percent of all use occurs during a three month period on less than three percent of the total wilderness area.[6] The uneven distribution of use, coupled with increasing use, has contributed to problems and conflicts, especially in the more heavily visited portions of each wilderness.

Problems associated with some heavily visited areas are in conflict with the intent of the Wilderness Act of 1964 (P.L. 88-577), the enabling legislation which sought to protect wilderness areas through federal statutory classification.[7] Prior to 1964, the U.S. Congress passed the Multiple-Use Sustained-Yield Act of 1960 (P.L. 86-517) which set forth the basic land use planning directives for national forest management. This act designated all five U.S. Forest Service resources (wood, water, range, wildlife, and recreation) of equal importance and mandated they be managed as such.[8] The Wilderness Act isolated wilderness as a management entity with distinct goals from general forest recreation management as addressed in the Multiple-Use Sustained-Yield Act. Reaffirming its prerogative to establish long term goals for national forest management of renewable resources, Congress passed the Forest and Rangeland Renewable Resources Planning Act of 1974 (P.L. 93-378).[9] This act was amended to permit greater flexibility in Forest Service operations with the passage of the National Forest Management Act of 1976 (P.L. 94-588).[10] These acts provide for Congressional designation of wilderness areas and the protection of the areas through comprehensive land use planning, which includes the preparation of wilderness management plans.

This federal legislation has been interpreted for its wilderness management implications by the U.S. Department of Agriculture (Code of Federal Regulations, Title 36, Part 293), and by the U.S. Forest Service (Forest Service Manual, Title 2300). Forests with wilderness responsibilities prepare a wilderness management plan and when necessary, specific management problems are addressed in a detailed

action plan.

Within the National Forests of Oregon and Washington (Region 6) there are eighteen wilderness areas totalling 2,757,631 acres. These areas amount to approximately seventeen percent of the entire National Wilderness Preservation System, which surpasses the combined wilderness acreage for the National Park Service and the National Wildlife Refuges (Fig. 2). In these eighteen wilderness areas, six wilderness plans have been approved by the regional forester, leaving twelve plans still in preparation.[11] Some of the existing plans are presently being updated to reflect recent additions, while others are being improved to eliminate certain inadequacies.

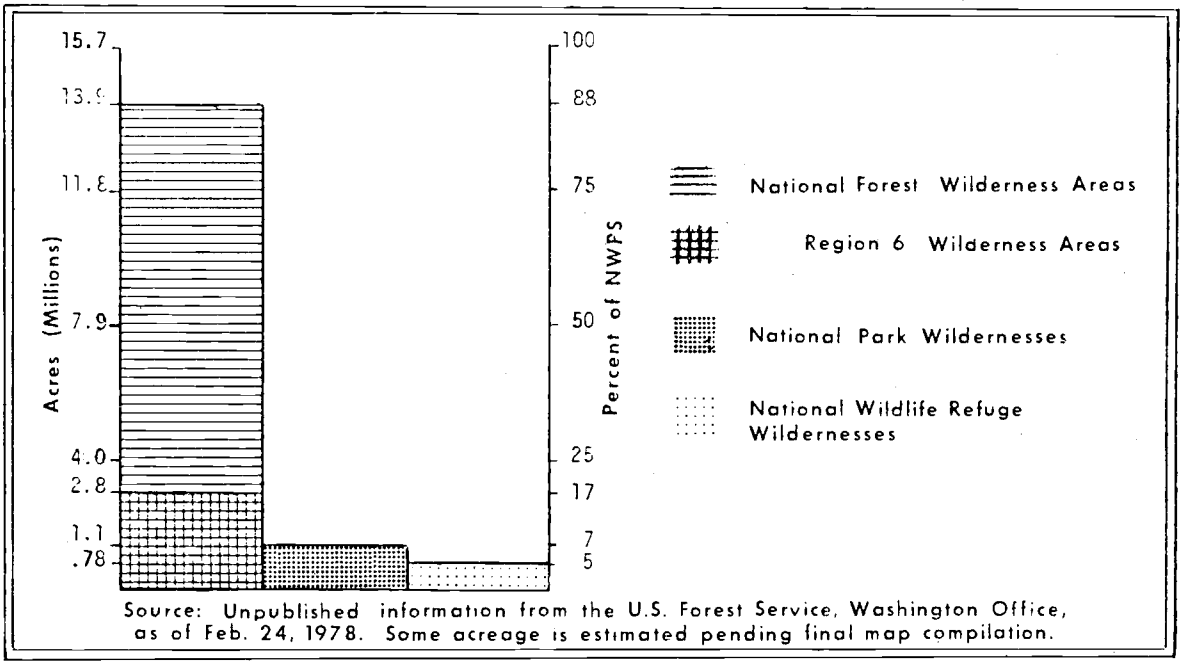


Fig. 2. The National Wilderness Preservation System

In addition, approximately 2.9 million acres in Oregon, and 2.1 million acres in Washington have been identified in the National Roadless Area Review and Evaluation (RARE II) process.[12] By January 1979, the regional forester will recommend to Congress that specific roadless areas within this five million acres be classified as wilderness. Future classifications will necessitate either additions to existing management plans or the drafting of new management plans.

Constraints exist which have hindered optimal management of wilderness areas. Some of these constraints are: 1) lack of a consistent interpretation, among managers, of the intent of the Wilderness Act; 2) lack of continuity among Presidential administrations in the interpretation of the U.S. Forest Service's role in wilderness management; 3) agency administrative problems, such as budgets, lack of communication, and knowledge; and 4) limited knowledge of techniques in wilderness planning due to the relative newness of this field and the decentralized nature of the U.S. Forest Service.

Related Research

Research articles discussing aspects of wilderness management are numerous. Nash's explanation of the evolution of wilderness philosophy provides an excellent background for understanding current problems in wilderness management.[13] Robinson provides a more concise overview of the evolution of wilderness philosophy as an introduction to his discussion of the varying definitions of wilderness and Forest Service wilderness management problems.[14] Increasing wilderness use and patterns of visitor distribution throughout wilderness areas are discussed by Stankey, Lucas, and Lime.[15] Several studies examine the sociological characteristics of the wilderness visitor.[16] These studies indicate the majority of wilderness visitors are under thirty, male, and highly educated. The visitor generally stays less than two nights, travels less than ten miles, and appreciates diverse environments. Hendee and Potter note that hunters often typify the socioeconomic characteristics of the general population.[17] Most hunters seek a variety of satisfactions from their visit, rather than just hunting success.

Franklin provides some guidelines to assist managers with the incorporation of ecosystem information into the wilderness planning framework.[18] Frissell notes the curvilinear relationship existing between campsite deterioration and use intensity.[19] Bell and Bliss support this relationship, stating that in subalpine and alpine ecosystems, the rate of plant establishment following disturbance is extremely slow.[20] Brown et al. note that revegetation of a high elevation site is extremely complex; they suggest some techniques to aid managers.[21] Cole states that impacts resulting from human use are concentrated, and affect selected portions of the total wilderness, while fire suppression and grazing policies can affect successional change throughout the entire wilderness.[22] Helgath determined that landform, vegetative habitat type, and trail grade had greater effects on trail erosion and bog formation than other factors.[23]

Numerous studies examine the concept of recreational carrying capacity as it applies to wilderness.[24] Hendee et al. developed a system for inventorying dispersed recreational sites (Code-A-Site).[25] Hendee et al. suggest techniques for acquiring public input for forest service decision-making.[26] Clark and Stankey provide managers with guidelines to facilitate effective analysis of the public input.[27] Lucas states that neither the ecosystem nor the social structure of the wilderness can survive a "no management" approach. He supports more intensive management in lieu of the alternatives.[28]

Merriam and Knopp suggest developing the recreational opportunity spectrum outside of wilderness areas as a possible technique to reduce wilderness congestion.[29] Shafer et al. utilized the Delphi Technique to record predictions that the wilderness will be more intensively managed, including visitor entry restrictions, by 1985.[30] Stankey and Baden present five direct rationing systems and supply managers with guidelines useful in choosing and implementing a specific rationing system.[31]

These studies discuss some characteristics of wilderness visitors and problems which have developed from both increasing use and the uneven distribution of use throughout wilderness areas. They present management methods in a conceptual framework which facilitates a holistic approach to wilderness management. However, the studies do

not integrate current wilderness problems with the management methods implemented to mitigate these problems, on an area specific basis, in the Pacific Northwest.

Purpose and Objectives

The purpose of this study was to compile and analyze information on wilderness problems and the management techniques currently being used to mitigate the problems. The study examined techniques implemented in selected wilderness areas in Oregon and Washington in order to facilitate Region 6 wilderness management and planning.

The specific objectives of the study were: 1) identify the problems which exist in a heavily used portion of each selected wilderness area and examine the characteristics of the environments in which these problems occur; 2) determine the various management tools and techniques utilized in these areas and the managers' evaluations of the success of these techniques; and 3) discuss the Forest Service's ranking of the problems and compare the relative success of methods applied to common problems existing in the selected areas.

Definition of Terms

Management plan. A management plan is prepared for each designated wilderness area. The plan is founded on the goals of the Wilderness Act, the Code of Federal Regulations, and the Forest Service Manual directives. It is influenced by regional guidelines and individual National Forest characteristics. The goals and objectives which are set forth in the plan define the specific management direction of each wilderness.[32]

Action plan. The action plan specifies the daily and yearly actions which are necessary to implement the management goals and objectives. Personnel from the different ranger districts meet annually to assure coordination of the district action plan.

Code-A-Site. This is a system for the inventory of dispersed recreation sites which utilizes edge-punch cards and needle-sorting methods for recording, storing, and retrieving basic campsite

information.[33]

Visitor-day. The visitor-day is a standard unit of measuring recreation use. One day is defined as an aggregate stay of one person for twelve hours, or two people for six hours, etc.

Ecosystem. Odum defines an ecosystem as: "A unit of biological organization made up of all of the organisms in a given area . . . interacting with the physical environment so that" it "exhibits a recognizable unity both in function and in structure."[34]

Environment. As used in this report, environment refers to individual natural features, or combinations of features, such as vegetation or soils.

Subalpine parkland. Franklin and Dyrness offer this definition: "The parklands constitute an ecotone [a transition zone] in which tree dominance is gradually giving way under the increasingly harsh alpine environment. Typically, the area between forest line and scrub line is a mosaic of tree patches and meadow communities, the former gradually being reduced in area and in stature as elevation increases."[35]

II. RESEARCH DESIGN

Study Areas

The wilderness areas chosen for study were: 1) Eagle Cap Wilderness in the Wallowa-Whitman National Forest; 2) Glacier Peak Wilderness in the Mt. Baker-Snoqualmie National Forest; 3) Goat Rocks Wilderness in the Gifford Pinchot and Snoqualmie National Forests; and 4) Mt. Jefferson Wilderness in the Willamette National Forest (Fig. 3). These areas were selected in accordance with the following criteria: 1) the area had an existing wilderness management plan; 2) there was an identifiable heavy use area within the wilderness; 3) each wilderness had unique characteristics; and 4) the wilderness managers were willing to participate in the study.[36]

Within each wilderness a specific study area was identified through consultation with the wilderness management officer for each forest. The study area represented a portion of the wilderness which had received or was receiving a considerable amount of use. Consequently, the area had been more intensively managed than other portions of the same wilderness, and managers were familiar with selected management techniques.

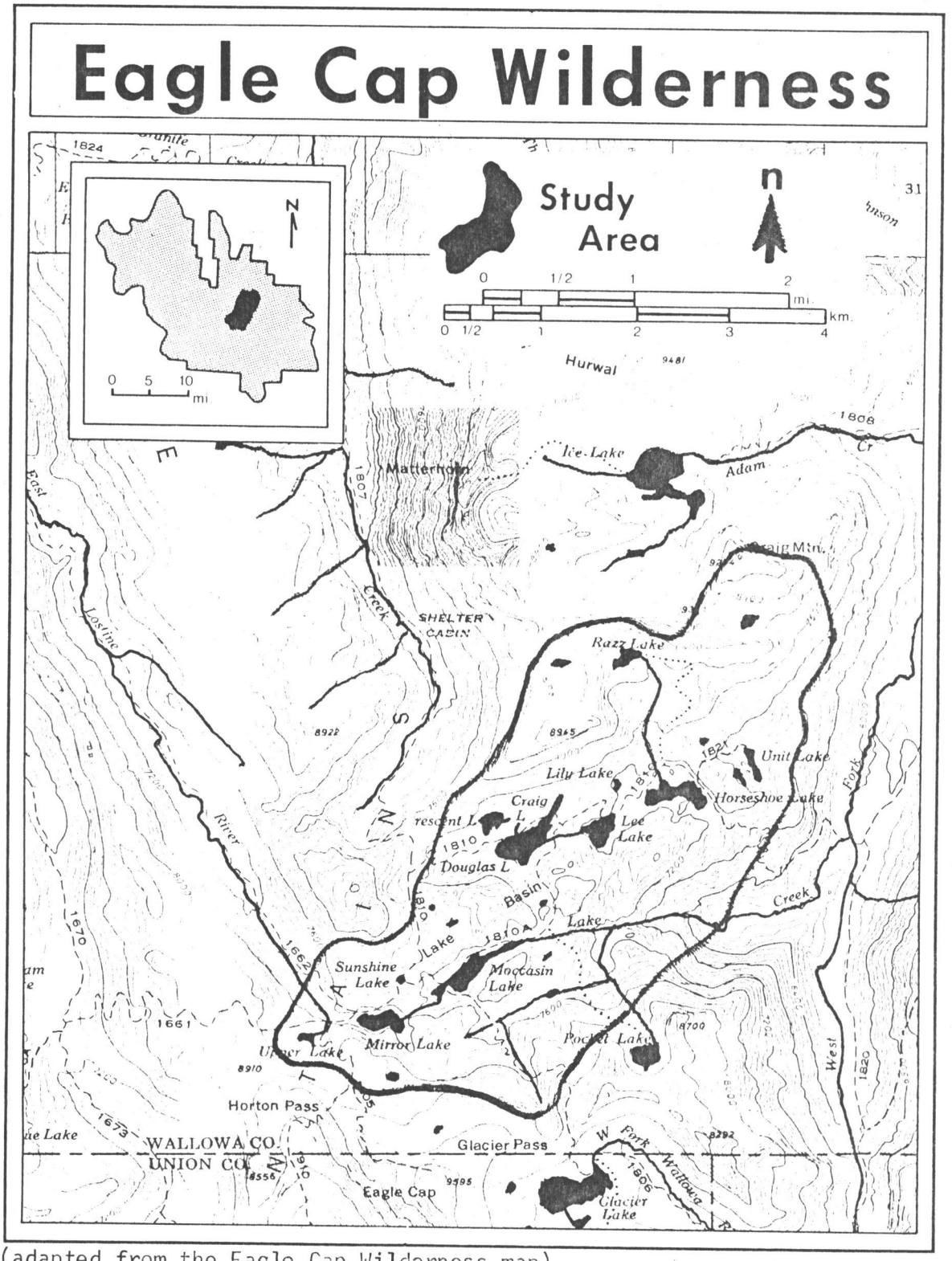
Eagle Cap Wilderness. The wilderness area is fairly remote, being approximately 640 km (400 mi.) from Portland and the Willamette Valley, and 160 km (100 mi.) southeast of Pendleton. The attraction of Eagle Cap is well described in Wilderness Trails Northwest:[37]

> Some Oregonians, not entirely enraptured by volcanoes, declare the Wallowa Mountains are the state's finest and the Eagle Cap Wilderness its grandest. The rocks are a mix of greenstone, marble, granite, and basalt uplifted by faulting. Ice Age glaciers broadened valleys, down which the rivers sparkle, and scooped cirques which hold more than 50 lakes. Forests are varied and beautiful, as are the large alpine meadows and the numerous snow-capped peaks.

Within the wilderness, the study area, which is known as Lake Basin, ranges from 2129 to 2494 meters (7000 to 8200 feet) (Fig. 4). The

(adapted from the Forest Service, Region 6, Resources Planning Act map)

Fig. 3. Wilderness Study Areas, Region 6.



(adapted from the Eagle Cap Wilderness map)

Fig. 4. Eagle Cap Wilderness Study Area

area is a day's hike or ride from two of the most popular trailheads in the wilderness.[38] Lake Basin is ecologically diverse with vegetation common to subalpine parklands and alpine meadows. The area is also visually diverse with an abundance of lakes, snowfields, and rock outcrops creating many edge effects (Fig. 5). The popularity of Lake Basin supports research findings which indicate the recreationist prefers diverse environments.[39]

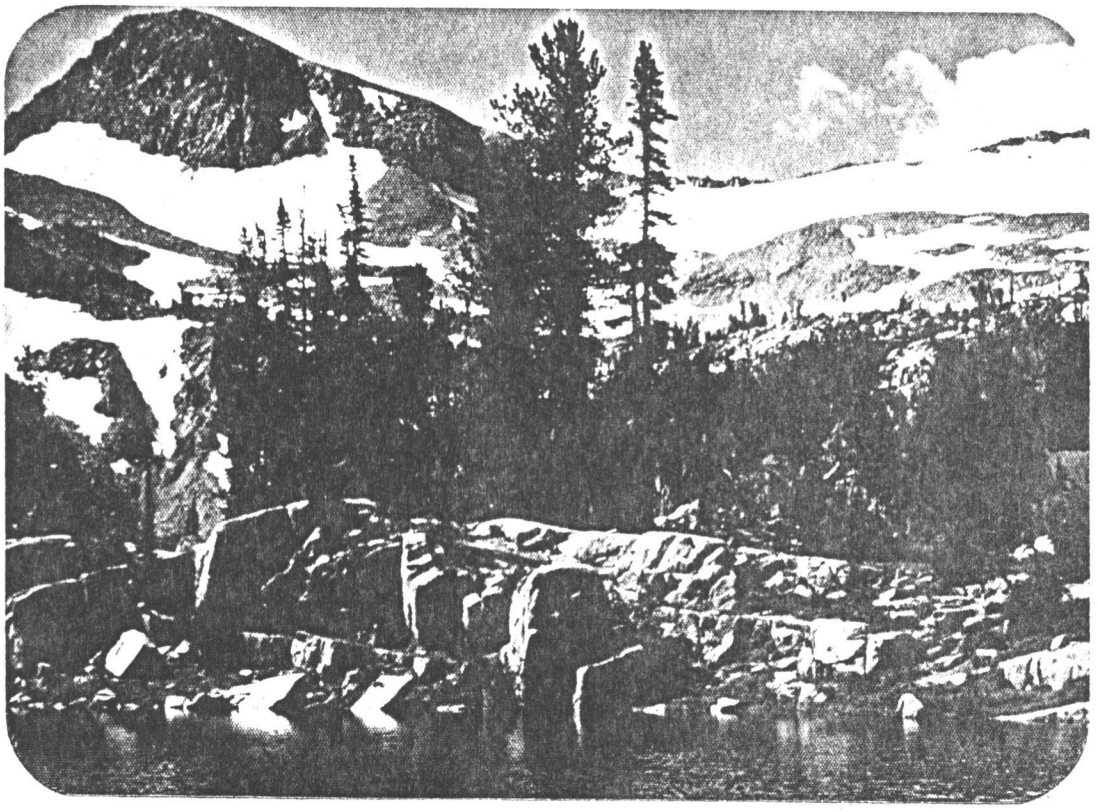


Fig. 5. Visual diversity attracts many visitors to subalpine parkland environments (Eagle Cap Mountain, 2915 m., Sunshine Lake).

Wilderness permits, required for day and overnight visits during all seasons, are available at Wallowa-Whitman National Forest offices, by telephone, or by mail. Permit data indicates the majority of wilderness visitors are not from local communities, but are from urban areas. During the summer season, over 50 percent of all visitors are from the Willamette Valley. The wilderness has historically been heavily visited by horseriders; however, 1977 permit data indicates horse use now represents approximately 30 percent of the total

wilderness use.[40] The average group size for hikers is 3.5 people while the average group size for horse groups is 4.5 horses. Hand tabulated permit data indicates visitation is fairly consistent throughout the season. Managers felt this results from the lengthy distance many visitors travelled to visit Eagle Cap Wilderness.

Glacier Peak Wilderness. This wilderness, located 144 km (90 mi.) from the Seattle metropolitan area, is very accessible. Within the study area, use was concentrated in the vicinity of Image Lake, which is a two day hike or ride from the trailhead (Fig. 6).[41] The uniqueness of the study area is described by Spring and Manning:[42]

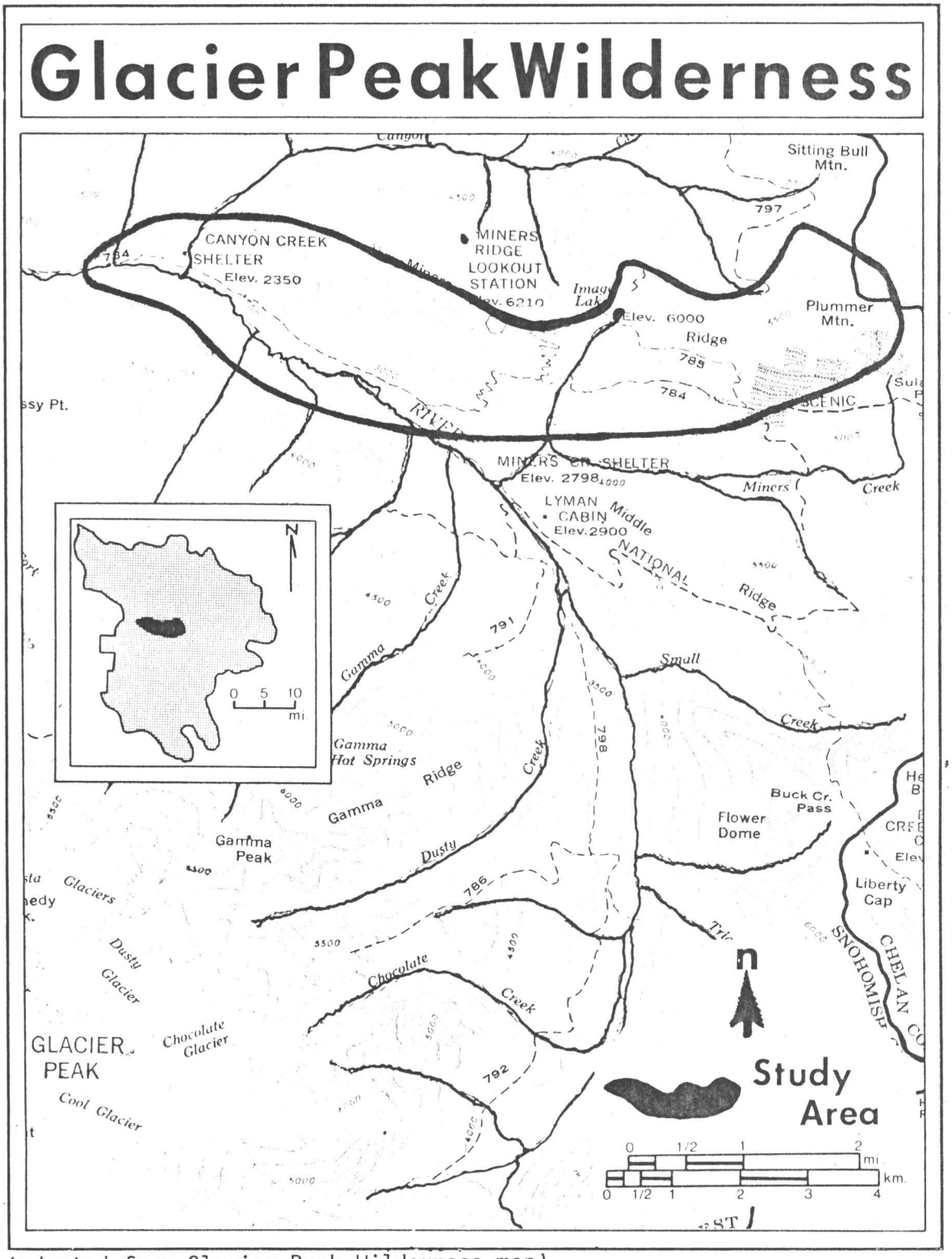
> A 2 mile high volcano, the image of its glaciers reflected in an alpine tarn . . . hikers have voted this a supreme climax of the alpine world of the North Cascades and the nation . . . in a single day there have been more than 150 campers at Image Lake . . . Don't come to Image Lake expecting privacy . . . Indeed, over-use of the lake threatens its integrity.

The lake is at 1825 m (6000 ft.) which is approximately timberline. Vegetation of the area is that which is common to subalpine parkland ecosystems.[43] Thornburgh's vegetative studies in 1961, 1966, and 1971 have provided a foundation for managers to evaluate the impact of recreational use on the vegetation.[44]

Wilderness permits, required for overnight visits during all seasons, are available at Mt. Baker-Snoqualmie National Forest offices, by telephone, or by mail. Permit data for 1977 indicates that 82 percent of the wilderness visitors are from the state of Washington, with 40 percent directly from the Seattle area. Almost 95 percent of these visitors are hikers with an average group size of 3.4 people.[45] The use is skewed with weekends and holidays receiving peak use.

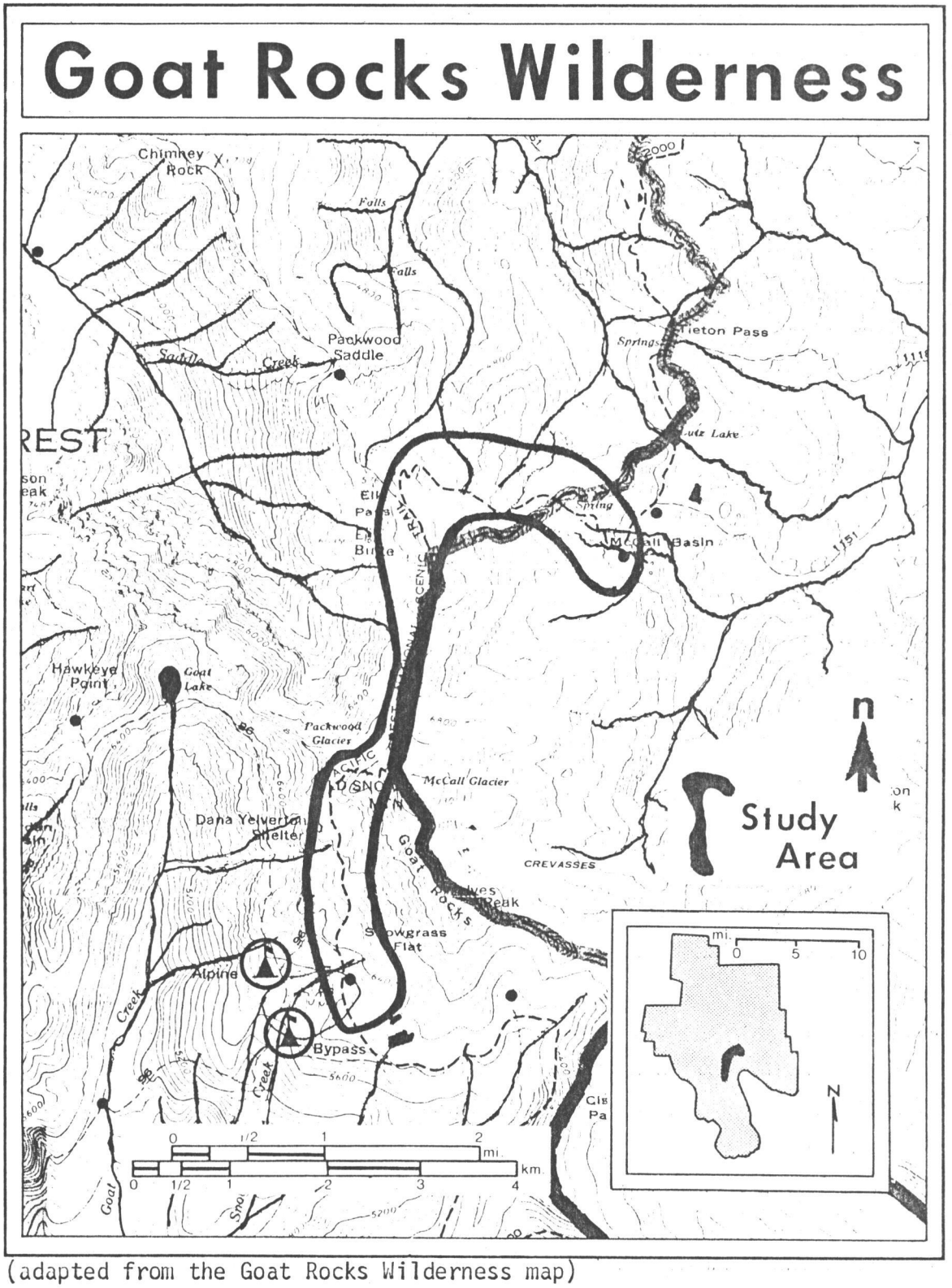
Goat Rocks Wilderness. The wilderness is approximately 160 km (100 mi.) from both Yakima and the Tacoma-Olympia area. The crest of the Cascade Mountains divides Goat Rocks management between two National Forests: the Gifford Pinchot to the west and the Snoqualmie (administered by the Wenatchee) to the east (Fig. 7).

The area contains two different ecosystems: the lower subalpine parklands of McCall Basin and Snowgrass Flat and the arctic and alpine



(adapted from Glacier Peak Wilderness map)

Fig. 6. Glacier Peak Wilderness Study Area



(adapted from the Goat Rocks Wilderness map)

Fig. 7. Goat Rocks Wilderness Study Area

area of Old Snowy Mountain (Fig. 8). In the early summer, visitors are especially attracted to the subalpine parklands which are richly carpeted in wildflowers. Spring and Manning describe the beauty of Snowgrass Flat:[46]

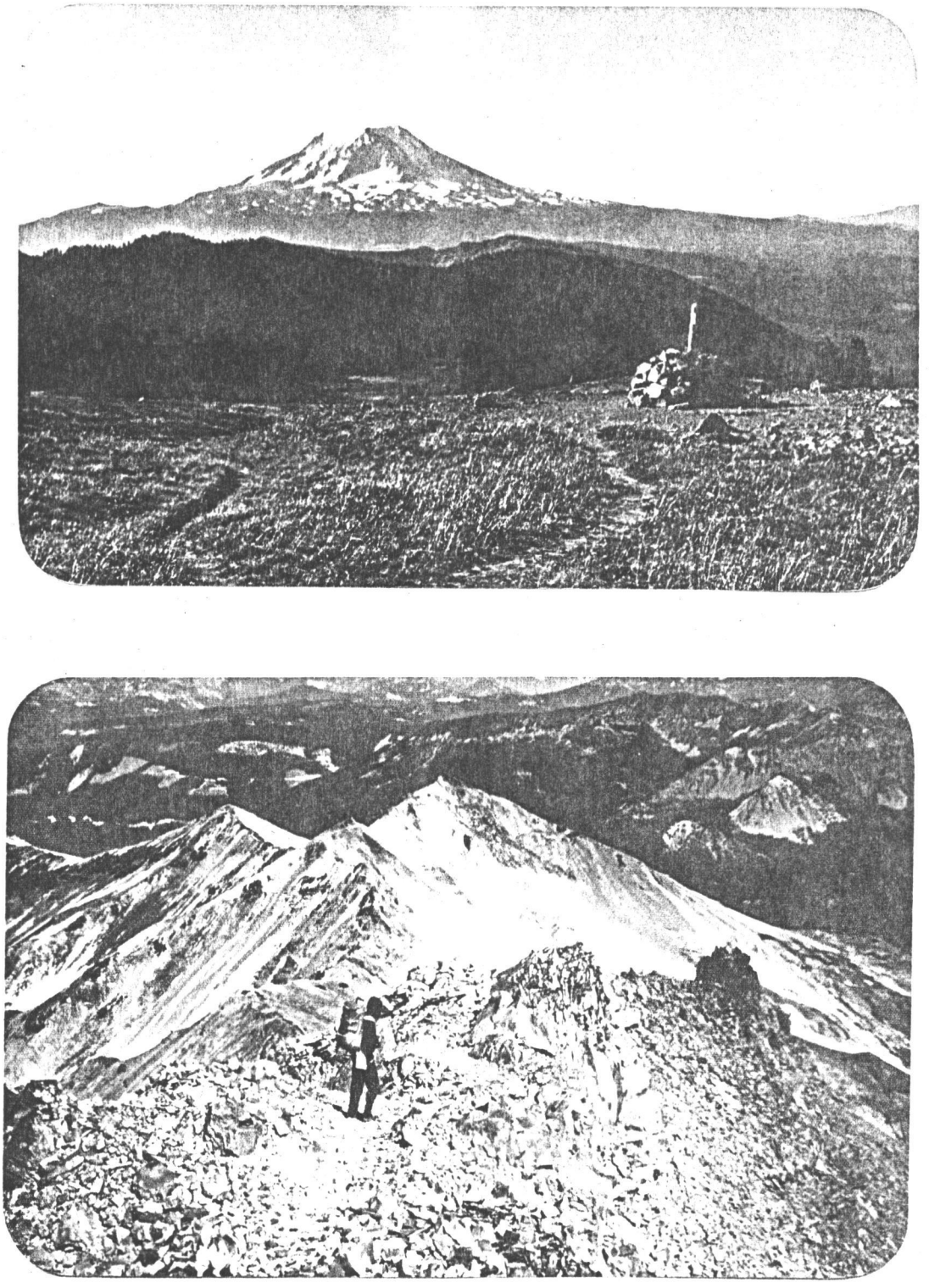
> One of the most famous meadows in the Cascades, a riot of color during flower season. But when the flowers are gone the vast parklands higher up, with views of Adams, St. Helens, and, of course, the Goat Rocks, still make the trip a genuine spectacular.

Both Snowgrass Flat (1947 m., 6400 ft.) and McCall Basin (1525m., 5200 ft.) are easily reached in a day's hike.[47] They provide excellent overnight locations before the Pacific Crest Trail hiker crosses the crest of the Cascades. William O. Douglas aptly describes why he was attracted to the Goat Rocks:[48]

> These peaks of the Goat Rocks are not high as Western peaks go; they are around 8200 feet. But no mountain I have been on, not even Adams, creates the same feeling of height . . . The sides drop directly off into steep canyons plastered with glaciers on the east and with rocks on all sides. When one peers over the eastern edge he looks almost straight down a thousand feet or more . . . [the wind] flicked specks of sand from the ridge as it licked its cool tongue first one way and then another into the recesses of the leeward side of this backbone of rock. It whined through the broken escarpment of the ridge, whirling madly around each pinnacle or finger of rock.

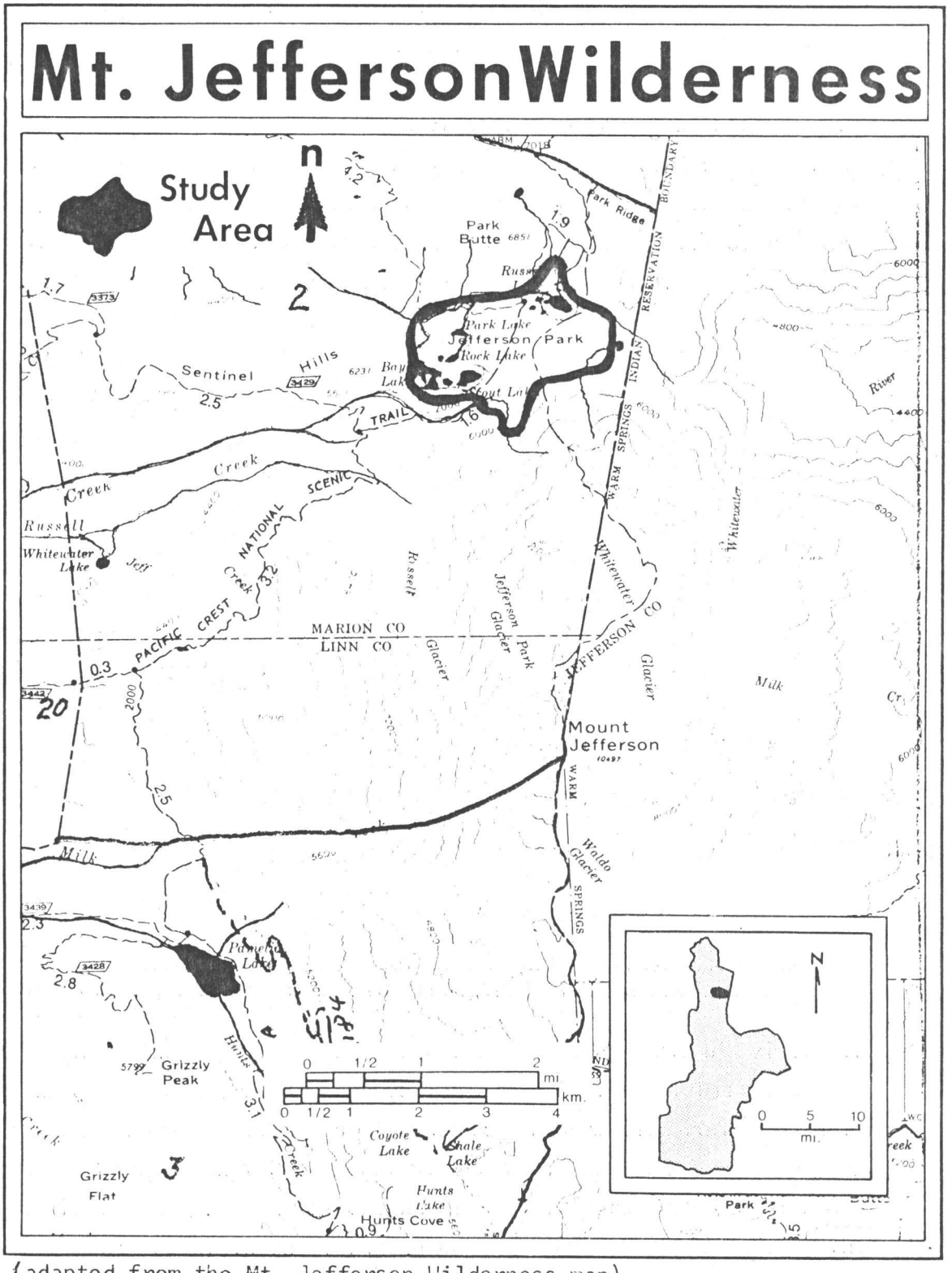
Wilderness permits, required for overnight visits from May 15 to November 15, are available at Gifford Pinchot and Wenatchee National Forest offices, by telephone, or by mail. Difficulties with the computer program resulted in a lack of programmed visitor use information for the 1977 season. Gifford Pinchot managers hand tabulated permits and estimate that the average group size was 3.8, horse use amounted to five to ten percent of the total use, and approximately 90 percent of the visitors stayed 5.7 visitor days.[49]

Mt. Jefferson Wilderness. The wilderness is less than a two hour drive from both the Corvallis-Salem area (120 km, 75 mi.) and Bend (80 km, 50 mi.). The study area is known as Jefferson Park and is



(photo credits: Wayne Parsons)

Fig. 8. The Goat Rocks Wilderness Study Area represented two ecosystems: the lower subalpine parklands of Snowgrass Flat (Mt. Adams, 3743 m.) and the alpine zone of Old Snowy Mountain.



(adapted from the Mt. Jefferson Wilderness map)

Fig. 9. Mt. Jefferson Wilderness Study Area

located in the northeastern section of the wilderness (Fig. 9). Spring and Manning describe the area's uniqueness: "Lake-dotted Jefferson Park, in some opinion the loveliest meadow in the state, spreads green lawns and flower gardens at the northern base of the volcano," (Fig. 10).[50] Jefferson Park is an easy day's hike from the trailhead at Forest Service Road 1044 and from the Breitenbush Lake trailhead.[51] The area is at 1764 m. (5800 ft.) and has vegetation common to subalpine parkland ecosystems. It is well located for lunch on a day's hike or as a base camp for climbers seeking the summit of Mt. Jefferson, the second highest mountain in Oregon (3193 m., 10,497 ft.).

(photo credit: Detroit Ranger District)

Fig. 10. An aerial view of Jefferson Park portrays the park-like vegetative patterns common to subalpine parkland environments.

Wilderness permits, required for day and overnight visits from June 15 to November 15, are available at trailheads, Willamette National Forest offices, by telephone, or by mail. Permit data for 1977 indicates that 30 percent of the total use consists of day use. Of the overnight use, 87 percent of the visitors stay two nights or less, and travel in an average group size of 3.5 individuals. This data supports the weekend peaks evident in Figure 1. Ninety percent of the overnight visitors are from Oregon, with 87 percent of the Oregon visitors coming from the Willamette Valley counties.[52]

Methodology

Information was gathered from existing management and action plans, wilderness use statistics, a questionnaire, and personal interviews. The management plans provided background information for the study areas. The plans delineated the management goals, objectives, and planning methodologies designed to reduce conflicts for each area. The other available information varied by forest. Each forest provided wilderness guard field reports which were individualistic and often discussed the field application of a management technique. Glacier Peak was the only wilderness which had prepared an action plan for the study area. Other pertinent data was gleaned from: Forest Service memoranda. visitor education material provided by each forest, Code-A-Site reports, and use statistics.

The accuracy of the Recreational Inventory Management (RIM) statistics, which were generated from permit data for wilderness areas, was questioned by some of the managers. The reasons supporting this concern were: 1) some of the permits were not completed in an acceptable format for computer analysis; 2) managers monitoring use during the hunting season noted a general lack of compliance with the permit system among hunters; and 3) visitors sometimes altered their travel route from that listed on the permit which resulted in erroneous use figures for some areas.[53] The type of computer data generated for each wilderness varied; therefore, constraints imposed by the permit data should be recognized in the interpretation of RIM data.

A questionnaire was developed in consultation with the Survey Research Center, Oregon State University and was pre-tested orally with two wilderness managers.[54] The questionnaire was distributed to each district ranger with the request that he coordinate the response of the wilderness managers for the study area. Managers were requested to rank wilderness concerns by the following ordinal scale categories: "Very Important" (4), "Somewhat Important" (3), "Not Too Important" (2), and "Not A Problem" (1) and to explain why any concerns were ranked "Very Important." They were to identify management methods implemented to mitigate "Very Important" concerns and then rank the effectiveness of these techniques by the following ordinal scale

categories: "Very Effective" (4), "Somewhat Effective" (3), "Not Too Effective" (2), "Not At All Effective" (1). Managers were requested to explain why techniques were categorized as effective or not effective. Available documentation of the reasons for the ranking was requested. After completing all the concern categories, managers were to list the three most severe problems existing in the study area.

The content analysis of the questionnaire was based on a discrepancy and frequency analysis of the identified problems and techniques. A discrepancy analysis was done to the response of each area which compared the ranked concerns, three main problems, and management methods. This identified any discontinuities in problem identification and in the applied level of management intensity. A frequency analysis between wilderness areas compared the ranked concerns, three main problems, and management methods. This provided a comparison of the type of problems identified, and the management approaches implemented, by study area. Discrepancies arising from this analysis were the basis for the personal interviews with the wilderness management officer, district ranger, and other Forest Service wilderness management employees. The interviews clarified these problems and permitted a more thorough analysis of each study area.

III. STUDY AREA PROBLEMS

Problem Identification

The most severe problems identified by managers for each study area were grouped into two problem categories. These categories represented problems in either the degradation of the environment (camping areas or trails), or in agency administration.

Degradation of the environment was considered a problem because it was incongruous with the goals and objectives set forth in the wilderness management plan for each area. As noted earlier, the function of the plan is to uphold the goals of wilderness management which were mandated in the Wilderness Act of 1964. Although not all managers had a similar interpretation of the applied intent of these goals, most of them agreed with Franklin's interpretation that, "the job of wilderness management is often to insure that the dynamics of the ecosystem and resulting successional change--the natural trajectory of the ecosystem--proceed without disruption or distortion by man."[55] The managers felt wilderness management was not always meeting this goal, and the limit of acceptable change had been surpassed in selected areas of the wilderness.[56] However, with a few exceptions, managers utilized no techniques to quantify their ranking of environmental degradation or their decision-making. Additionally, there were no regional definitions of unacceptable levels of degradation to serve as guidelines for managers.

Agency administrative concerns were defined as problems when they hindered optimal management of the study area. Although not identified as frequently as resource degradation, "Very Important" agency problems were noted to some degree by most areas (Table 1).

It is notable that managers did not identify any social concerns related to visitor satisfaction as "Very Important." This does not represent the actual satisfaction level of visitors but reflects manager's perception of the visitor's level of satisfaction. Managers noted this was a professional judgment based on the few visitor

TABLE 1. RATING OF PROBLEMS AND THE CONCERNS IDENTIFIED AS "VERY IMPORTANT" BY STUDY AREA

PROBLEM CATEGORIES	STUDY AREAS				
	Eagle Cap	Glac. Peak	Goat Rocks West	Goat Rocks East	Mt. Jeff.
Environmental Degradation					
Camping Areas:					
Destruction & loss of vegetation	(2)	(2)			(1)
tree root damage	*				*
cutting limbs, snags	*	*			*
ground cover dest.-campsite	*	*	*	*	*
ground cover dest.-trampling	*		*	*	
Campsite erosion & compaction	(2)		(1)	(3)	(2)
campsite erosion	*			*	
campsite compaction	*		*	*	*
Campfire scars	(2)*	(3)*			(2)*
Lack of a wilderness ethic		(1)*			
refuse	*				
private horse use		*	*	(2)*	
noise					*
Concentration of recreationists	(3)*				
group's size		*			
Trails:					
Non-system (informal, social, multiple)	*	*	*	*	(3)*
destruction to vegetation		*	*		
Improper location	*		(2)*	(1)*	*
grade			*	*	
bogs				*	
maintenance			*	*	
conflicts among user groups			(3)*		
compaction	*		*		
erosion		*	*	*	
Administration					
Lack of communication	(1)*				
signing	*				
Budgets			*		*
Time	*			*	
Seasonal employees	*			*	

( ) Indicates the relative ranking of problems by study area managers.

* Concerns identified as "Very Important" by study area managers.

complaints received regarding the condition of the resource or the use of the area. This judgment supports some sociological research which indicates that as people become accustomed to increasing densities of use in wilderness areas, they modify their normative definition of acceptable levels of contact to include what they experience.[57] Study area managers do not know what the current norms of the different user groups are, and therefore feel it is impossible to plan for all their needs and preferences.

Environmental Degradation

Camping Areas. Deterioration of camping areas was identified by managers when they perceived excessive evidence of environmental damage. Although managers did not have a common definition of what constituted unacceptable environmental damage, they all agreed that deterioration of some camping areas was occurring. Some indicators they listed of camping area deterioration were: destruction and loss of vegetation, campsite compaction and erosion, and a proliferation of campfire scars. These factors were interrelated and most were identified by managers as "Very Important" concerns (Table 1).[58] The only area which had a documented base from which to evaluate the level of deterioration was Glacier Peak.[59] Although all areas had been inventoried through Code-A-Site, only Eagle Cap managers utilized Code-A-Site figures to support their ranking of campsite deterioration.[60]

There are many factors contributing to camping area deterioration. The uneven distribution of the increasing wilderness use has led to a concentration of recreationists in some areas.[61] Research indicates that people are attracted to areas which are visually diverse and offer the most spectacular scenery.[62] In wilderness areas, greater visual diversity is more often found at higher elevations in the subalpine parkland and alpine zones, rather than in the lower elevation forests. Unfortunately, high elevation areas are ecologically fragile and easily impacted by visitors.[63]

The Forest Service has contributed to this concentration unintentionally by providing information to the visitor which promotes the grandeur of these fragile areas. Additionally, the Forest Service has in some cases facilitated access through the construction of roads

which service wilderness trailheads. From the road, the visitor often travels into the wilderness on a well maintained trail which routes him directly into spectacular but sensitive areas. The design of the trail system is critical as approximately 80 percent of all wilderness visitors remain on the trails.[64]

Managers suggested that a factor which has compounded the effects of concentrated use has been a lack of a wilderness ethic among visitors. Generally, the factors leading to increased wilderness use have not been accompanied by educational programs teaching visitors how to protect the resource. For example, while the camper understands the mechanics of setting up his tent, he often is unaware of how or where to set up the tent to minimize social or environmental impacts. Lack of proper handling of saddle and pack stock can lead to irreparable damage to vegetation (Fig. 11). Wallowa-Whitman managers noted

Fig. 11. The use of trees as hitching posts can destroy or permanently damage the trees and surrounding vegetation.

the distinction between a wilderness "user," who leaves evidence of his trip (perhaps for decades to come), and a wilderness "visitor" who passes through the wilderness carefully. All study area managers felt the ethics practiced by individuals have considerable bearing on the number of people an area can absorb before surpassing the limit of acceptable change.

Trails. Deterioration of trails was a "Very Important" concern of all managers. According to managers, indicators of trail deterioration were: a proliferation of non-system (also known as social, informal, multiple) trails; trail erosion leading to gullies and exposed bedrock; expansion of bog-like areas; and difficulty maintaining the condition or, in some cases, the location of the trail (Table 1). It was difficult for managers to pinpoint when trail deterioration became unacceptable as some levels of degradation were expected from general use. However, each area did have trail deterioration concerns which were severe enough to be considered priority problems (Fig. 12).

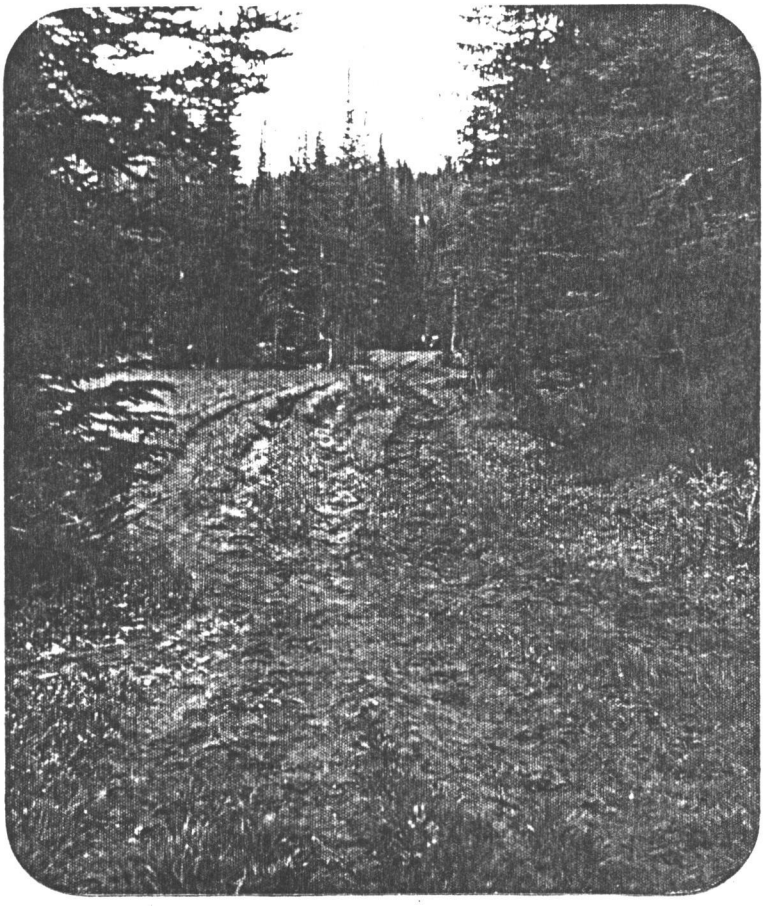


Fig. 12. The poor location of trails through wet areas can lead to the development of multiple trails which circumvent the trenched areas.

Managers identification of trail location as the principal cause of deterioration supported Helgath's findings.[65] The placement of many of the trails, decades ago, was functional; whereas, today the design of the trail is based on criteria to provide for recreational needs and the protection of the natural environment. Managers are confronted with a trail system which developed incrementally, without environmental considerations, and consequently has led to trail deterioration and the routing of visitors into fragile environments. In these areas, it is difficult to control the proliferation of social trails between campsites and water sources (Fig. 13).

(photo credit: Bernard A. Smith)

Fig. 13. The proliferation of social trails between campsites and water sources was a serious problem of all study areas (Image Lake).

A problem interrelated with trail location and trail deterioration was conflicts between user groups on the Old Snowy Mountain section of the Pacific Crest Trail in Goat Rocks Wilderness (Fig. 8). The wilderness managers were attempting to meet both the goals of the National Trails System Act (P.L.90-543) and the Wilderness Act.[66] By following the intent of the National Trails Act in locating a trail on the crest of the Cascades, the Goat Rocks managers have

been burdened with the following environmental constraints in the Old Snowy section: 1) segments of the trail are subject to erosion or mass wasting; 2) the extreme ruggedness of the area makes the trail difficult to maintain; and 3) the narrowness of the trail makes it hazardous for user groups (especially those with packstrings) to pass each other safely (Fig. 8).

Administrative Problems

Some agency problems resulted from the organizational structure and decentralized nature of the U.S. Forest Service. In each study area, there was more than one ranger district, and sometimes more than one National Forest, administering the same wilderness. Without clear definitions and agreement between districts and between forests, of what constituted unacceptable environmental degradation (or any problem), it was difficult to: 1) reach common agreement among managers of the wilderness management goals and objectives; 2) define priority problems; and 3) select and implement a technique which alleviated the problem. Some managers felt this situation was complicated by the assignment of some personnel to wilderness management positions for which they had no specialized education or training. Most managers expressed some frustrations with the limitations imposed by budget cuts, hiring policies, and other agency constraints (Table 1).

Wallowa-Whitman managers identified difficulties in communication existing between the four districts administering Eagle Cap, and also between the different National Forests in Region 6. Their concern was that the divergent management methods within the region were confusing to the wilderness visitor and sometimes resulted in misunderstanding and a lack of compliance with the regulations. Eagle Cap managers were not advocating uniform management between National Forests, but did suggest that attempts at consistency could be advantageous to the U.S. Forest Service and to the public.

IV. MANAGEMENT METHODS

Categories of Management Methods

The tools and techniques utilized by study area managers were classified into the following categories of management methods: 1) visitor management; 2) resource management; and 3) administrative methods. Among the categories, methods of visitor management, involving both educational and regulatory techniques, were implemented the most frequently. Resource management techniques involved the actual manipulation of the resource (e.g., site rehabilitation) and were less frequently utilized by all managers. Techniques of administrative management (e.g., Code-A-Site) were not commonly used to quantify management decisions.

The interrelated nature of the techniques made it difficult to identify the individual effectiveness of a technique. For example, it was difficult to know if a visitor had complied with a camping setback regulation because: 1) he had been taught that it was not ethical to camp close to lakeshores regardless of regulations; 2) he was aware of and had respect for the federal regulation; or 3) due to rehabilitation the site was no longer immediately recognized by the camper as an obvious campsite. These reasons for compliance can be mutually exclusive or interdependent, based on the camper's awareness of regulations and his level of camping etiquette. Because the techniques were often interrelated, and managers sometimes utilized techniques from different categories to mitigate a problem, the management categories will be discussed by the primary problems. These techniques do not represent an exhaustive list of the available techniques, but an examination of the techniques which have been implemented in the Region 6 study areas.

Techniques Implemented for Environmental Degradation

Camping area deterioration. This problem was the most frequently identified by all managers as "Very Important." The

educational visitor management methods attempted to: 1) modify the visitor's behavior through the promotion of low impact camping techniques, and 2) alter the distribution of visitors by implementing dispersal techniques.

Low impact camping programs were initiated in Glacier Peak Wilderness (1976) and in Eagle Cap Wilderness (1977) as a positive means of mitigating impact. Previously, managers had relied on regulations to control behavior. They were not satisfied with visitor compliance nor with the effectiveness of the regulations. In lieu of imposing more regulations, or strictly enforcing the existing ones, managers chose to supplement the existing regulations with educational programs designed to educate visitors on how to protect the resource. Managers implemented the program through Forest Service publications, meetings with special interest groups, and visitor contact by wilderness guards. Additionally, some unique implementation methods were incorporated into each management strategy.

Glacier Peak managers prepared a seasonal pamphlet, The Glacier Peak Journal, which was distributed to visitors applying for permits and at special interest group meetings. They felt most visitors were appreciative of the creative design of the Journal and referred to it as a source of current information. Glacier Peak managers have utilized the newsletters of Seattle area conservation organizations as another means of educating some visitors as to wilderness ethics or other management methods. Wilderness bulletin boards were utilized to post regulations and to inform visitors of specific management projects, such as the rehabilitation program at Image Lake. This information was generally handwritten by the wilderness guard and therefore reflected current conditions. The boards (approximately two feet by two feet) were strategically located at trail junctions or convenient resting spots within the heavy use areas.

Eagle Cap's initiation of a no trace camping program in 1977 was reported by the local newspapers. Judging from the amount of feedback which managers received, the coverage was effective at the local level. In an effort to contact a larger percentage of the visitors, a no trace camping bulletin board (approximately four feet by six feet)

was located near a heavily used trailhead outside the wilderness boundary. Because the board was at a trail junction about a quarter mile from the parking lot, it was read while visitors readjusted packs or waited for the rest of the group. The managers stated the board would have been more effective if professional interpretative material had been available for posting. All study area managers supported this concern and expressed interest in the regional or national office expanding their efforts to include the provision of creative posters, bulletins, and brochures. This material should instruct the visitor how to protect the resource through relevant displays, such as no trace camping.

Some managers, or wilderness guards, met with special interest groups in an effort to improve communication and gather support for specific management methods, such as the Pack-it-Out Program (Table 2). The managers found that contacting a few supportive leaders, prior to meeting with the entire group, could lead to better total group acceptance of the programs.[67] Meetings with local special interest groups do not reach people who are not group members nor most non-local visitors. Wilderness guards patrolling within the wilderness contacted some of these individuals. All area managers valued the guard as the Forest Service field representative who had an opportunity to make effective camp contacts. However, the number of contacts a guard could make was limited, and sometimes the contact occurred after the damage was done. Therefore, managers felt it was critical to reach most of the visitor population prior to trip departure.

All managers felt that the regional office support and promotion of low-impact camping would either strengthen their existing program or contribute to the initiation of their program. The challenge of a regional low-impact camping program lies in reaching the target audience without publicizing wilderness and generating more use. Wallowa-Whitman managers felt that to be effective a comprehensive program should be implemented on a national and regional level, and complemented by inter-agency coordination. For example, all managers stated that more impact was generated during the fall hunt than throughout the entire summer season. Managers expressed difficulties contacting hunters prior to their trip, as many do not belong to local special

TABLE 2. MANAGEMENT METHODS IMPLEMENTED FOR PRIMARY PROBLEMS BY STUDY AREA

MANAGEMENT METHODS IMPLEMENTED FOR THE PRIMARY PROBLEMS	PRIMARY PROBLEMS OF THE STUDY AREAS							
	I. Environmental Degradation							II. Administration
	Camping Areas					Trails		
	Destruction of Vegetation	Compaction and Erosion	Campfire Scars	Lack of Ethic	Concentration - Recreationists	Non-System	Location	Lack of Communication
I. Visitor Management Techniques								
Educational								
Low-impact camping program	GP EC	EC	EC	GP	EC			
Visitor dispersal	GP	WGR EGR		EGR GP	EC			
Preferred campsites	GP	WGR		GP				
Wilderness guards	MJ GP	EC MJ WGR	MJ	EGR	EC			
Meetings with special interest groups		EC		GP WGR EGR	EC			
Public news release		EC WGR		EGR GP	EC			
Newsletters private organizations	GP			GP				
USFS brochures, maps	GP	WGR		GP EGR				
Field signing		EC GP WGR		GP				
Visual Management, (e.g., string fences)	GP					GP		
Pack-it-Out program				GP EGR	EC			
Regulatory								
Camping set-back (water)	MJ	EC MJ						
Camping set-back (trails)		WGR EGR						
Camping closure (area)	GP	WGR		GP		GP		
Campfire set-back (water)	GP	MJ	EC MJ GP					
Limitation group size		EGR WGR		GP EGR				
Wilderness guard enforcement	GP		GP	GP				
II. Resource Mgmt. Techniques								
Site rehabilitation	GP							
Fire ring obliteration			EC MJ GP					
Trail relocation	GP					GP	GP EGR WGR	
Trail rehabilitation						MJ EC WGR GP	WGR GP	
Hitchracks	EC	EC			EC			
III. Administrative Techniques								
Code-a-Site	EC GP MJ	EC EGR MJ WGR	EC MJ					EC
Photo point survey		MJ						
Formal activity review								EC
Wilderness workshop								EC
Scientific vegetative analysis	GP							

EGR-East Goat Rocks (Wenatchee N.F.) GP-Glacier Peak Wilderness
WGR-West Goat Rocks (Gifford Pinchot N.F.) EC-Eagle Cap Wilderness
MJ-Mt. Jefferson Wilderness

interest groups nor were they from local communities. Hendee et. al. have found that approximately 25 percent of all hunters belong to sportsmen's organizations and 60-80 percent regularly read sportsmen's magazines.[68] National coordination of the low-impact camping program might gain the cooperation and support of some of these organizations. On a regional level, the distribution of a brochure, promoting a land ethic and minimum impact camping techniques, with the purchase of any type of hunting license, might lead to improved camping etiquette among hunters. In this circumstance, agency coordination would be advantageous. The managers felt attempts to educate visitors as to low impact camping techniques had merit as an element in the entire management framework; however, it should not be viewed as a panacea for all problems.

The other primary educational method utilized to lessen camping area deterioration was to attempt to alter the distribution of visitors through dispersal techniques. These techniques varied in the way managers chose to suggest alternate camping areas to visitors who were headed for, or camped at, heavily visited areas. It is notable that some managers felt the study areas attracted a different type of visitor than other portions of the same wilderness. They felt many of the visitors to the study area were: 1) non-local; 2) destination oriented; 3) relatively inexperienced at wilderness camping; 4) seldom disturbed by encounters with hikers; and 5) often not sensitive to impact on the natural environment, with the exception of trash. These observations support some sociological research which indicates that value judgments may vary between wilderness visitors and managers.[69] Managers felt these characteristics sometimes negated dispersal attempts.

The most intensive dispersal efforts were implemented at Glacier Peak and Goat Rocks-West. Because sections of the study areas had been closed to camping, bulletins were provided at the ranger station which explained the closure and suggested alternate areas to camp. Visitors seemed more receptive to altering their travel plans when alternate areas were suggested. Managers observed that the suggested sites rapidly degraded to a certain level and then stabilized, provided the visitation level did not increase.[70]

Goat Rocks, Glacier Peak, and Eagle Cap managers used trailhead, or

wilderness signs, to advise visitors of heavily visited areas. News releases advised some visitors of "problem" areas. Goat Rocks managers indicated selected camping areas on the wilderness map. Generally, some information was provided to the visitor, and he made the decision as to where to visit. All study area managers relied on the wilderness guards to advise the visitors they contacted in the wilderness of the heavily visited areas, and to recommend alternate, less populated areas. All study area managers were interested in utilizing more visitor dispersal techniques; however, they also expressed concern over the possible negative effects of dispersing visitors to fragile or little used areas.

Within the study areas, visitor management by regulation has been a more traditional management approach than education. Each study area had one or more federal regulations prohibiting specific actions. In 1977, Glacier Peak was the only study area with guards who were authorized to issue federal citations (Notice of Violation) to enforce the regulations. However, only one citation has been issued in three years. All areas posted the official regulations sheet at the trailheads and also in the ranger stations. Some areas provided visitors with bulletins regarding specific regulations (e.g., Goat Rocks-West closure for Snowgrass Flat) or brochures explaining all the wilderness regulations, such as the Eagle Cap Rules and Regulations or the Glacier Peak Journal. The regulations were occasionally signed at selected problem areas, such as lakeshores with camping set-backs.

The Wallowa-Whitman managers initiated a 200-foot camping set-back from all Eagle Cap lakeshores in 1970. The Willamette managers initiated a 100-foot camping and campfire set-back from the Mt. Jefferson lakeshores in 1977. They both observed that the regulation increased the social carrying capacity of the areas. However, unless enough campsites existed behind the set-back limit, there was an increased proliferation of campsites. The old campsites near the lakeshore retained their physical identity as campsites because ground cover vegetation was absent. Neither of the area's managers made an intensive attempt to rehabilitate the sites. Wilderness guards reminded visitors of the regulation and asked them to move their camp if it was within the set-back limit. Compliance with the regulation was fairly good

provided there was a sufficient number of existing or potential sites behind the set-back limit.

A 200-foot camping set-back from the Pacific Crest National Scenic Trail was implemented in Goat Rocks. The exception to this regulation was a 100-foot limit in McCall Basin, where most of the existing sites were just beyond 100 feet and in timbered areas. Managers felt this regulation increased the social capacity of the area by reducing the number of campsites which were visible from the Pacific Crest Trail.

In Glacier Peak and Goat Rocks-West, it was determined that a set-back was not sufficient to mitigate the severe degradation existing in some fragile, but heavily visited areas. Glacier Peak managers banned camping in the Image Lake area in 1975 and Goat Rocks-West managers banned camping in Snowgrass Flat in 1969. Both closures were well publicized in newspapers, organization newsletters, and by Forest Service brochures or bulletins. Additionally, Glacier Peak managers signed the area and had a wilderness guard enforcing the regulation. Visitors were advised of alternate camping areas when applying for permits, at trailheads, and in the wilderness. The majority of the public's response was positive to the closure. The managers felt the closure had been effective in facilitating attempts at revegetation or the natural rehabilitation of the areas. The alternate campsites, which were chosen because of their site hardiness, tended to immediately degrade and then stabilize at a certain level.

In 1975, the Goat Rocks and Glacier Peak managers implemented a group size limitation in an attempt to disperse large groups and lessen their social and environmental impact.[71] The Goat Rocks managers felt the limitation was not too effective because the increasing use of Goat Rocks outweighed the effects of smaller group size. The Glacier Peak managers felt the limitation reduced impact in areas such as Image Lake where large groups had a tendency to congregate. Although Glacier Peak use figures fluctuate annually, depending on the seasonal rainfall and snowpack, they indicate that visitation is not rapidly increasing, and may be stabilizing.

Within the study areas, the resource management methods which were

implemented to mitigate camping area degradation were fairly limited. The exception to this was Glacier Peak's intensive site rehabilitation program. The efforts have been concentrated in the Image Lake environs, particularly at the campsites which are closest to the lake. The managers based their strategy on Thornburgh's vegetative analysis and recommendations. The rehabilitation program has included: transplanting of native plants, collecting and sowing of native seeds, loosening of compacted soil, watering, mulching, foot traffic control, and rooting of cuttings. It was difficult to isolate the effectiveness of each technique since they often were implemented simultaneously, but managers did note that transplanting was more effective than seeding. However, the transplanting has also resulted in a series of "pits" which have remained visible. Managers also noted the tendency for an artificial garden-like appearance to result from the string fences and obvious planting patterns (Fig. 14).

(photo credit: Bernard A. Smith)

Fig. 14. String fences and transplanting are part of the site rehabilitation program at Image Lake.

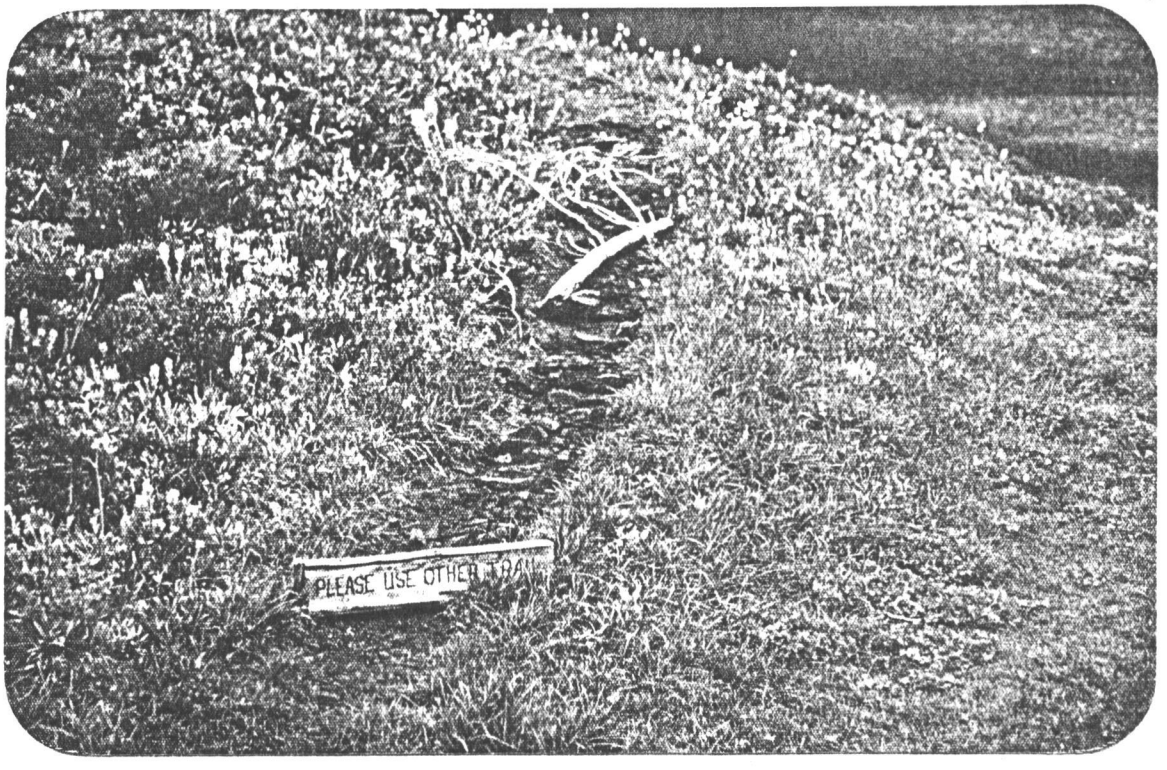
The implementation of this program and the camping ban were well promoted through newspaper articles, organization newsletters, Forest Service bulletins, wilderness permit contacts, wilderness signs, and wilderness guard contacts. The complementary nature of these techniques were considered a "Very Effective" means of facilitating the rehabilitation program. Furthermore, the intensity of the program in such a small area resulted in a "demonstration area" where visitors often became more aware of the potential severity of recreational impact. The condition of the area, after seven years of effort, indicates that high elevation rehabilitation can be partially successful but it is an extremely complex and challenging task.

The other resource management methods utilized by the study areas were either fire pit destruction or the use of hitchracks. Wilderness guards in Glacier Peak, Eagle Cap, and Mt. Jefferson obliterated fire rings within the no camping areas to facilitate natural restoration of the site. Destroying fire pits was also effective in reducing the area's visual appeal as a campsite. Hitchracks were installed in selected areas in Eagle Cap to localize damage and protect vegetation. However, managers stated that not enough racks were installed to have noticeable results. The hitchrack placement was as difficult as that of outhouses; they must be visible without being obtrusive.

Administrative techniques utilized to mitigate camping area deterioration included a Code-A-Site inventory of all the study areas and the use of photo essays in Mt. Jefferson. Although managers had inventoried the areas, they generally did not refer to the Code-A-Site results as a means to quantify management decisions. Wallowa-Whitman managers found Code-A-Site to be a method to stratify the severity of camping area deterioration throughout the entire wilderness, regardless of ranger district boundaries. Repeat photography from a permanent point is another method of quantifying an area's condition by evaluating the vegetative changes. In Jefferson Park, photo essays compare the vegetative changes of some sites from the 1920's to 1977.

Trail Deterioration. All study area managers felt the proliferation of non-system trails, and the deterioration of poorly located trails, were serious impacts because there is no effective method of rehabilitating severely degraded trails.

Glacier Peak managers utilized string fences and routed logs to visually deter visitors from non-system trails (Fig. 15). Rehabilitation of these trails consisted of spading the compacted area, scattering available native seed, and filling the trench with downed debris (which is often scarce at high elevations) or rocks to reduce erosion. Managers felt the combination of these methods had reduced non-system trail use while also educating visitors of the need to remain on the main trails. Although scars remained, some non-system trails were beginning to blend in with the landscape.



(photo credit: Bernard A. Smith)

Fig. 15. Non-system trails were spaded and identified by routed logs to deter visitor use.

Managers in other areas attempted to rehabilitate non-system trails by filling in the trench and blocking off the entrance with natural debris and rocks (Table 2). If preventative techniques were implemented before the trail was severely eroded, degradation was sometimes controlled. However, once eroded trails were well established, managers had no effective means of restoring them to a natural state.

Trail location was a primary problem of Goat Rock's managers. They found it difficult to locate a stable trail, which was suitable for horse use, on the crest of the Cascades without incorporating engineering methods inharmonious with wilderness. This situation will be field analyzed in the 1978 season. Additionally, the trail on either side of the ridge was severely eroded. In places it was poorly located through swampy areas which had led to a proliferation of trails. The trail was relocated in the timber around Snowgrass Flat and is being relocated in the timber above McCall Basin. Relocation should reduce overnight camping in McCall Basin and permit some rehabilitation.

Techniques Implemented for Administrative Problems

All area managers identified some administrative problems as "Very Important." Eagle Cap managers were more concerned with communication difficulties because of the Wallowa-Whitman division of wilderness administration between four ranger districts and because of the area's isolation from the visitor population centers. The recommendations of an administrative audit (known as a Formal Activity Review) of wilderness included: 1) placing all wilderness responsibilities with one wilderness manager, and 2) creating one wilderness ranger district which would include all four districts.

The study area managers viewed the Region 6 Wilderness Management Workshop as a beneficial information sharing and problem solving meeting. The workshop, held April 4-6, 1978, represented the first assemblage of wilderness personnel from each National Forest in Region 6. In addition, representatives from other Forest Service regions, and the National Park Service, provided information on their management problems and strategies.

Effectiveness of Techniques

Managers identified factors which they felt had increased the effectiveness of the method. Collectively these factors were: 1) clear identification of the problem; 2) thorough evaluation of alternate techniques; 3) coordinated implementation through ranger district action plans; 4) effective diffusion of the information to the public; and 5) periodic evaluation of the results of the method.

Identification of unacceptable environmental degradation varied between National Forests and within a National Forest. The severity of the problem influenced the effectiveness of the technique. Therefore, because problems are evaluated differently, the effectiveness of a technique in one area may not determine its effectiveness elsewhere.

The evaluation and selection of alternatives for both the cause (e.g., lack of a wilderness ethic) and the evidence (e.g., destruction to vegetation) of a problem might increase effectiveness of the techniques. The interdependent nature of the techniques often required that complementary techniques from each category (visitor management, resource management, and administrative methods) be evaluated, selected,and implemented.

Effective implementation of the selected techniques was related to the utilization of an action plan. Coordination of the districts' action plans insured a more holistic management approach through the clarification of each district's wilderness responsibilities.

The managers felt visitor compliance with a regulation was increased if they understood the reasons behind the regulation. Methods that were used to increase visitor awareness of the regulation included: 1) identifying the visitor's origin from the permit data and then focusing information sharing tactics in this area; 2) requiring visitor-agency contact through the permit system and supplying accurate information to the visitor during this contact; and 3) providing information at trailheads and on-site via wilderness guards. These strategies indicate that diffusion of information through each of the five stages of the recreational experience (anticipation, travelling to, on-site, return travel, and recollection) increases visitor

awareness of the management methods. Furthermore, effectiveness might be increased if creative publications are distributed to visitors for "take-home value; they can be read and reread at a visitor's leisure."[72]

Periodic evaluation of the results of the techniques is important to determine levels of effectiveness. However, managers have little baseline information from which to make these observations. Identification of the implementation strategy in action plans would provide a record of management methods which were utilized for a particular problem.

V. SUMMARY

The increasing recreational use of wilderness and the uneven distribution of use throughout wilderness areas have contributed to problems and conflicts in wilderness management. In addition, there are constraints which hinder optimal wilderness management. One constraint is the decentralized nature of the Forest Service which makes it difficult for managers to be aware of the problems and management techniques utilized in other wilderness areas. The purpose of this study was to compile and analyze information on wilderness problems in four Region 6 wilderness areas and to examine the management techniques utilized to mitigate the problems. The wilderness areas were: Eagle Cap, Glacier Peak, Goat Rocks, and Mt. Jefferson. Within each area, a heavily used section was designated as the study area.

A questionnaire and personal interviews were used to identify the primary problems in the study areas. These problems were more similar than dissimilar and were classified in the following two categories: environmental degradation involving camping areas and trails; and agency administrative problems. The managers agreed that environmental degradation was occurring in the study areas, although none of the managers, nor the regional office staff, had a common definition of unacceptable environmental damage. Some of the indicators which managers used to identify camping area damage were: destruction and loss of vegetation, campsite compaction and erosion, and a proliferation of campfire scars. Managers suggested that environmental degradation sometimes resulted from a concentration of recreationists in sensitive areas and from a lack of wilderness ethics among some visitors. Indicators that managers used to identify trail degradation included: a proliferation of non-system trails, erosion and compaction, and difficulties maintaining the trail in compliance with required standards. Managers identified poor trail location as the primary cause of deterioration. All areas classified some agency administrative problems as "Very Important" but generally these problems were not ranked as important as environmental degradation. The exception to this was Eagle Cap Wilderness where managers were primarily concerned with

communication difficulties within the Wallowa-Whitman National Forest and between the National Forests in Region 6.

The management methods used by study area managers included: 1) visitor management involving both educational and regulatory techniques; 2) resource management involving the direct manipulation of the resource, such as site rehabilitation; and 3) administrative methods, such as Code-A-Site. Visitor management methods were utilized the most frequently by the managers. They stated that visitor management through regulation had not effectively mitigated impact in all cases. The managers have been hesitant to actively enforce the regulations or to burden the public with more regulations. Therefore, some managers were beginning to integrate more educational techniques, such as low impact camping methods, with regulatory methods. For example, Glacier Peak managers strengthened their intensive site rehabilitation program through educational visitor management methods which explained the rehabilitation program to the visitor. All managers viewed annual meetings, such as the April 1978, Wilderness Management Workshop, as a valuable opportunity to improve regional communication and share information. Eagle Cap Wilderness managers will begin the consolidation of wilderness management under one manager by the 1978 summer season.

The interrelated nature of the techniques made it difficult to identify the effectiveness of each technique. Managers noted that the complementary use of techniques from different categories, such as visitor management and resource management, seemed to improve the effectiveness of implementation. In addition, it was important that problems were clearly identified and techniques were selected that supported the wilderness plan's goals and objectives. Managers suggested that the use of seasonal action plans could lead to more effective implementation of the techniques. They also noted the importance of providing information to the public in such a way that they were aware of management methods before leaving for their trip.

VI. MANAGEMENT IMPLICATIONS

The problems and techniques identified in the four study areas have some implications for the management of wilderness areas within Region 6.

The problems reulting from a lack of wilderness ethics among some visitors might be mitigated through a comprehensive, national education program which instructs visitors how to protect the wilderness resource. The program could be coordinated with other agencies to facilitate contact with state and national organizations and to provide a unified effort at visitor education. The implementation of the program on both a regional and district level might lead to effective diffusion of information. Such a program would require a "Recreation Information Coordinator" at the Forest Service regional office and at each National Forest supervisor's office. The coordinator could disseminate educational information, conduct workshops to acquire public input, meet with special interest groups, and develop creative visitor education material for use throughout the region. In addition, the coordinator could integrate forest management concerns, such as fire management policies, into the public meetings.

The concentrations of recreationists in wilderness areas might be reduced by the development and promotion of a wide-ranging spectrum of recreational opportunities for the visitor. The publicity of available alternatives might lead to the dispersion of some visitors outside the wilderness.

If managers attempt to disperse visitors within the wilderness, the effects of this dispersion should be periodically evaluated. The dispersion of some visitors to other sensitive areas might generate more environmental impact throughout the entire wilderness. Furthermore, some areas probably should remain unique or rarely visited, to provide outstanding opportunities for solitude or to permit diversity in the wilderness experience.

The managers stressed the value of the wilderness guard as a uniformed Forest Service liaison with the wilderness visitor. However, some of the areas did not provide training which corresponded to the

responsibilities of the guard. This situation might be improved if the regional office provided a basic guard training outline which the managers could adapt to their specific needs.

All managers agreed that environmental degradation was occurring in the study areas, but neither they nor the regional office staff had a common definition of what constituted unacceptable environmental damage. There is a need for regional standards which delineate the minimum level of unacceptable degradation by ecosystem. The National Forest managers could increase the stringency of these standards if they desired. A Forest Service task force is studying the possibility of developing regional environmental and social standards for use in wilderness areas.

Ecological research indicates that rehabilitation of high elevation areas is complex and in some cases impossible within the planning time framework. Therefore, severe degradation should not be permitted under the assumption that future rehabilitation will restore the area to a natural condition.

The designation of a severely degraded area as a "demonstration site" for rehabilitation might have significant value as an educational display which portrays recreational impact on fragile environments.

It is difficult for managers to evaluate change because there is a lack of physical and biological baseline data. There is a need to begin gathering and systematically storing environmental information which will permit more quantification of future management decisions.

Communication between National Forest managers might be improved by annual wilderness management workshops. These workshops should be attended by managers and administrators so that the information will be laterally diffused throughout each National Forest.

Some communication problems between ranger districts or National Forests might be improved through the consolidation of each district's responsibilities under one manager. If wilderness was administered as an entity, regardless of ranger district or National Forest boundaries, it could be classified and managed by units based on ecological characteristics and patterns of visitor use. This might permit improved management.

The implications suggest that these wilderness areas will be

more intensively managed in the future. Managers identified some research needs which they felt would contribute to more effective management. The Mt. Jefferson, Eagle Cap, and Goat Rocks-East managers expressed a need for revegetation research which analyzes site hardiness and the rate of rehabilitation by ecosystem. The Goat Rocks-East managers would value a study which determines if limiting group size is an effective method to mitigate impact. This is a situation they cannot analyze because use rates have not been constant. The Goat Rocks-West managers are unsure of the status of the mountain goat population. A study analyzing the effects of the elk population, and the effects of hunting, on the goat population would contribute to their wilderness planning. In addition, the Goat Rocks-West managers would like more information on the amount of time spent by the visitor on each activity. The Glacier Peak managers feel more research emphasis should be placed on the interactions between the visitor and the natural environment, such as visitor perception of the natural environment and visitor impact on the environment. They would value applied research which could help determine the recreational carrying capacity of Glacier Peak Wilderness. Also, research discussing effective communication techniques for promoting management information would be valuable to Glacier Peak managers. These research needs indicate managers are concerned with the provision of more environmental and biological information to aid decision-making. In addition, some managers would like more information on characteristics of visitors in specific wilderness areas.

FOOTNOTES

1 This increase reflects use of U.S. Forest Service Primitive Areas existing prior to and after the Wilderness Act of 1964, and official U.S. Forest Service Wilderness Areas designated after 1964, see: George H. Stankey, Robert C. Lucas, and David W. Lime, "Crowding in Parks and Wilderness," Design and Environment, Vol. 7, No. 3 (1977),p. 1.

2 Unpublished visitor-day figures were obtained from: Recreation Staff, Use of National Forest Units, National Wilderness Preservation System, Calendar Year 1977 (Washington, D.C.: U.S. Forest Service, 1978).

3 Unpublished visitation figures were obtained from: Recreation Staff, Region Six Wilderness Visitor-Days (Portland, OR: U.S. Forest Service, 1978).

4 Stankey, op. cit., footnote 1, p. 2.

5 Stankey, op. cit., footnote 1, p. 2.

6 Personal communication with Roger Stamy, Wilderness Management Officer, Wallowa-Whitman National Forest, Baker, Oregon, December 12, 1977.

7 For the Congressional definition of wilderness and management goals, see: U.S. Congress, Wilderness Act, September 3, 1964, (78 Stat. 890; 16 U.S.C., 1131-1136) Sec. 2c.

8 For a detailed explanation, see: U.S. Congress, Multiple-Use Sustained-Yield Act of 1960, June 20, 1960, (74 Stat. 215; 16 U.S.C., 528-531).

9 U.S. Congress, Forest and Rangeland Renewable Resources Planning Act of 1974, August 17, 1974, (88 Stat. 476; 16 U.S.C., 1601-1610).

10 U.S. Congress, National Forest Management Act of 1976, October 22, 1976, (90 Stat. 2949; 16 U.S.C., 1600-1601).

11 Personal communication with Don Warmen, Planning and Special Projects, Recreation Unit, Region 6, U.S. Forest Service, Portland, Oregon, March 20, 1978. The six wilderness areas with management plans were: Strawberry Wilderness, Eagle Cap Wilderness, Three Sisters Wilderness, Mt. Jefferson Wilderness, Glacier Peak

Wilderness, and Pasayten Wilderness.

12 Personal communication with John Poppino, RARE II Coordinator, Planning Unit, Region 6, U.S. Forest Service, Portland, Oregon, April 10, 1978.

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14 Glen O. Robinson, "Wilderness," in The Forest Service: A Study in Public Land Management (Baltimore: Johns Hopkins University Press, 1977), pp. 152-198.

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18 Jerry F. Franklin, "Wilderness Ecosystems," in John C. Hendee, Robert C. Lucas, and George H. Stankey, eds., Wilderness Management (Washington, D.C.: Government Printing Office, in press).

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20 Katherine L. Bell and Lawrence C. Bliss, "Alpine Disturbance Studies: Olympic National Park, U.S.A.," Biological Conservation, Vol. 5, No. 1, (Jan., 1975), pp. 25-32.

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23 Sheila F. Helgath, "Trail Deterioration in the Selway-Bitterroot Wilderness," USDA Forest Service, Intermountain Forest and Range Experiment Station Research Note 93, (1973).

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George H. Stankey, "Criteria for the Determination of Recreational Carrying Capacity in the Colorado River Basin,"in Environmental Management in the Colorado River Basin. A. Berry Crawford and Dean F. Peterson, eds., (Logan: Utah State University Press, 1974), pp. 82-101.
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Eugene P. Odum, Ecology, (San Francisco: Holt, Rinehart and Winston, 1963), p. 11.

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36 These areas were chosen in consultation with Don Warmen, Planning and Special Projects, Recreation Unit, Region 6, U.S. Forest Service, Portland, Oregon.

37 Ira L. Spring and Harvey Manning, Wilderness Trails Northwest, (Beaverton, Oregon: Touchstone Press, 1974), p. 132.

38 Lake Basin is 12 km (8 mi.) from the Lostine River trailhead on Trail 1662, and 14 km (9 mi.) from the Wallowa Lake trailhead on Trail 1810.

39 Robert C. Lucas, "Hikers and Other Trail Users," in Recreation Symposium Proceedings, USDA Forest Service, Northeastern Forest Experiment Station (1971), pp. 113-122, p. 120.
Robert O. Brush, "Recent Developments in Landscape Assessment Research with Implications for Managing Forest Land for Recreation," in Outdoor Recreation Research: Applying The Results, USDA Forest Service, North Central Forest Experiment Station General Technical Report 9 (1974), pp. 83-86, p. 84.

40 For historical trends in use, see: Hendee, op. cit., footnote 17, p. 8. OR: U.S. Forest Service, A Resource Plan for Eagle Cap Wilderness, (Baker, Oregon: Wallowa-Whitman National Forest,1975), p. 9. Current use figures resulted from personal communication with Roger Stamy, op. cit., footnote 6.

41 Image Lake is 24 km (15 mi.) from the Suiattle River trailhead on Trail 784.

42 Ira Spring and Harvey Manning, 101 Hikes in the North Cascades, (Seattle: The Mountaineers, 1972), p. 98.

43 George W. Douglas, "A Preliminary Biological Survey of the North Cascades National Park and the Ross Lake and Lake Chelan National Recreation Areas," unpublished manuscript prepared for the National Park Service, 1969.

44 Dale A. Thornburgh, "Survey of the Recreational Impact and Management Recommendations for the Vegetation at Image Lake in Glacier Peak Wilderness," unpublished study prepared for the Mt. Baker-Snoqualmie National Forest, 1972, (Purchase Order 112-5-72).

45 This information was compiled from unpublished Mt. Baker-Snoqualmie National Forest permit data, "National Forest System Calendar Year 1977, Glacier Peak Wilderness," December 12, 1977.

46 Ira Spring and Harvey Manning, 102 Hikes in the Alpine Lakes, South Cascades, and Olympics, (Seattle: The Mountaineers, 1976), p. 145.

47 Snowgrass Flat is 8 km (5 mi.) from the Chambers Lake trailhead on Trail 96. McCall Basin is 11 km (7 mi.) from the Tieton Lake trailhead on Trail 1151.

48 William O. Douglas, Of Men and Mountains, (New York: Harper and Bros., 1950), pp. 337, p. 209.

49 Personal communication with Raymond W. Scharpf, Resource Assistant, Packwood Ranger District, Gifford Pinchot National Forest, April 19, 1978.

50 Spring, op. cit., footnote 34, p. 122.

51 Jefferson Park is 9 km (5.5 mi.) from FS Road 1044 on trail 3429 and from Breitenbush Lake on Pacific Crest Trail 2000.

52 This information was compiled from unpublished Willamette National Forest permit data, "National Forest System Calendar Year 1977, Mt. Jefferson Wilderness," March 17, 1978.

53 The first observation varied by forest for each year. For example, in 1977, there were 6,620 wilderness permits issued for Goat Rocks Wilderness, of which 2,430 were rejected by the computer. But, Goat Rocks managers have record of only 1,016 permits being issued. The situation is unresolved, leading to a deficiency in visitor-use information for the 1977 season. The third observation is difficult to quantify; however, the managers interviewed noted that their wilderness guards reported differences existed between where some visitors actually were and where their permit indicated they should be.

54 The wilderness managers were Dave Black, Other Resource Assistant, and Ray Crist, Forester, Detroit Ranger District, Willamette National Forest.

55 Franklin, op. cit., footnote 19, pp. 10-13.

56 Frissell and Stankey note there is continual ecological change within wilderness ecosystems; however, the limit of acceptable change has been surpassed when man's impact on the resource "causes the rate and character of the variations in the system to exceed the natural condition." See: Sidney S. Frissell, Jr. and

George H. Stankey, "Wilderness Environmental Quality: Search for Social and Ecological Harmony," in Proceedings, Society of American Foresters Annual Meeting, Hot Springs, Arkansas, (October, 1972), pp. 170-183, p. 176.

57 Thomas A. Heberlein, "Density, crowding, and satisfaction: sociological studies for determining carrying capacity," in Proceedings: River Recreation Management and Research Symposium, USDA Forest Service, North Central Forest Experiment Station General Technical Report 28 (1977), pp. 67-76.
Lucas and Stankey, op. cit., footnote 25, p. 16. See also: Richard L. Bury, "Carrying Capacity," Parks Recreation, Vol. 1, No. 1, (1976), pp. 23-25.

58 The only exception to this classification was the Goat Rocks Wilderness rating of campfire scars. Managers were primarily concerned with problems resulting from trying to construct and maintain the Pacific Crest Trail on the backbone of the Cascades. Gifford Pinchot National Forest had banned camping in Snowgrass Flat and designated lower elevation camping areas; the managers felt the campfire scars were "Not Too Important". Wenatchee managers felt the amount of campfire scars in McCall Basin were "Somewhat Important".

59 Thornburgh, op. cit., footnote 44.

60 Code-A-Site reports indicate that 35 percent of Lake Basin campsites are extremely compacted.

61 Stankey, op. cit., footnote 1, p. 2.

62 Brush, op. cit., footnote 39, p. 84.

63 Bell, op. cit., footnote 20, p. 27.

64 Stankey, op. cit., footnote 1, p. 1.

65 Helgath, op. cit., footnote 23, p. 10.

66 U. S. Congress, National Trails System Act, October 2, 1968, (82 Stat. 819; 16 U.S.C. 4601-4604).

67 Rogers and Shoemaker have termed group leaders early adopters and indicate that they can be an effective way to speed the diffusion of information. Additionally, they note that lateral diffusion among peers is more effective than attempting to diffuse information vertically through the ranks. See:

Everett M. Rogers with F. Floyd Shoemaker, Communications of Innovations: A Cross-Cultural Approach, Second Edition (New York: The Free Press, 1971) pp. 157-185.

68 Hendee, op. cit., footnote 17, pp. 144-45.

69 Heberlein, op. cit., footnote 57, p. 68.

70 This observation supports Frissell and Duncan's findings which state that "80 percent of the ground cover is lost with light use and there is little change with heavier use". Frissell, op. cit., footnote 20, p. 258.

71 The group size limitation for Goat Rocks was 12 persons. The limit for Glacier Peak was 12 persons and 15 horses per group.

72 William W. Dunmire, "Interpretive Publications," in Grant W. Sharpe, ed., Interpreting the Environment (New York: John Wiley and Sons, Inc., 1976) pp. 233-246, reference on p. 234.