

THE FEASIBILITY OF IMPLEMENTING A CAMPFIRE CLOSURE
IN A HEAVILY USED PORTION OF EAGLE CAP WILDERNESS

by

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THE FEASIBILITY OF IMPLEMENTING A CAMPFIRE CLOSURE
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ABSTRACT. Gathering and burning firewood in heavily used subalpine areas contributes to campsite deterioration. Forest Service policy directs wilderness managers to implement the principle of nondegradation. As a result, campfires may be prohibited in areas where fire-related impacts are significant.

The Lakes Basin and Ice Lake Travel Zones in the Eagle Cap Wilderness were studied. A review of available bio-physical data for the area indicate resource degradation as a result of campfire use is substantial. A survey of study area visitors reveal a strong affinity for campfires, but also a willingness to support a campfire prohibition policy if necessary to protect wilderness resources.

Managers from 14 wildland areas were contacted and asked to comment on the campfire regulations in their area. Most managers report good success with campfire restrictions, and believe there is no way large numbers of campfires can be permitted without seriously altering the visual and ecological resources of wilderness. Prohibition of all open fires in high-use areas is the most successful campfire management strategy employed by managers.

This study suggests there is good foundation for a campfire closure in the study area from a legal, resource degradation, visitor support, and administrative practicality perspective. Management implications of these findings are presented.

INTRODUCTION

Background

The passage of the Wilderness Act in 1964 established numerous wilderness areas and paved the way for the designation of many others. Currently, the USDA Forest Service administers approximately 25 million acres within the National Wilderness Preservation System (NWPS) (USDA wilderness status data, 1982). While designation of wilderness areas has helped ensure the preservation of part of our natural heritage, it has not addressed specific management problems within wilderness areas. The development and implementation of wilderness management techniques has not kept pace with the increasing land base, or with the social, esthetic, and ecological impacts that have resulted from increased recreational use of these wildlands during the past two decades.

A paradox exists in wilderness management. The 1964 Act directs managers to preserve the natural conditions of those lands within the NWPS while simultaneously providing recreational opportunities for the American people. The dual nature of the mandate is further complicated by the "special provisions" which allow for reservoirs, mining, and commercial grazing. However, the overriding goal of wilderness management is to permit, to the extent possible, the natural ecological processes to prevail. Hendee, Stankey, and Lucas (1978) feel that the Forest Service has recently begun to develop wilderness management policy guidelines that reflect this perspective. To the contrary, Klein (1982) identifies a management policy trend to increase the economic and recreational utility of wilderness.

Regardless of the diversity of wilderness uses, impacts associated with overuse of the resource base conflict with the intent of the Wilderness Act. Recreational impacts substantially alter the wilderness landscape. The

most obvious alteration, with the possible exception of trails, is campsite deterioration. Conditions at frequently used sites range from temporary unsightliness to permanent damage. These impacts include: exposed litter, garbage, and human waste; proliferation of campfire rings, blackened rocks, scattered ashes, and charred logs; erosion; compacted soil and elimination of campsite vegetation from trampling; reduction of adjacent woody debris, standing trees, and snags from firewood collection; and the presence of girdled trees and damaged roots from tying recreational livestock.

Campfire sites are a ubiquitous sign of humans in backcountry areas. The proliferation of campfires in heavily used areas represent an unnatural influence on the ecosystem and are contrary to the intent of wilderness designation. The Wilderness Act specifies a number of preservation-oriented goals that managers must strive to achieve. Accordingly, visual impacts associated with campfires, and resource problems resulting from the continual gathering and burning of scarce firewood in high-use areas should not be ignored.

Previous Studies

Little research has been devoted specifically to campfire impacts. Available studies indicate that continual gathering and burning of firewood contributes to campsite deterioration.

Most studies on backcountry campfire impact have been conducted in western wildernesses, particularly high-use alpine and subalpine areas. Visual and social aspects of campfires have been investigated by Buskirk (1975), Lucas (1979 and 1980), Hammit (1981), and Womble (1979). Ecological aspects of campfire use have been studied by Bratton and others (1978 and 1982), Davilla (1979), Fenn and others (1976), Schreiner (1978), and Cole and Dalle-Malle (1981). Of these studies, Cole and Dalle-Malle (1981)

provide the most comprehensive overview of impacts associated with collecting and burning wood.

In the Eagle Cap Wilderness, most research on campfire impact has been conducted in conjunction with other campsite studies. Campfire impact data are available from: Code-A-Site campsite inventory (1976-77), wilderness ranger reports (1977), and research by Cole (1977, 1981a, 1981b, 1981c, 1982). These studies suggest campsite impacts associated with building fires are significant in heavily used portions of the Wilderness.

Campfire Management in the Eagle Cap Wilderness

In the Eagle Cap Wilderness, an open-campfire policy is in effect, except during rare periods of extreme wildfire danger. Management action to deal with resultant campfire impacts in high-use areas has been limited to an information dispersal (visitor education) program. This program was launched in 1977 to inform visitors of the severity of campsite impacts and to describe camping techniques they could employ to minimize their mark on the land. Since its inception, visitor behavior and the condition of the backcountry have noticeably improved, particularly in the reduction of garbage and litter (Bradley, 1979). Unfortunately, campfire impacts in the heavily used areas have not improved.

In an effort to minimize visual and resource impacts, backcountry visitors, until recently, have been encouraged by the Forest Service to erase all signs of their visit, including fire rings. This policy, while well-meaning, literally disperses impacts to larger and larger areas as new fire rings are constructed and dismantled. Visitor education is a powerful resource management tool that can have an influence on modifying visitor behavior. But in areas where use is high and campfires are allowed, impacts

associated with fires are inevitable. Educating visitors to practice good camping ethics plays a vital role in reducing campsite deterioration, but it is not a total solution.

Forest Service Wilderness Management Standards

The USDA Forest Service Pacific Northwest Region (of which Eagle Cap is a part) wilderness standards direct managers to adopt the management principle of nondegradation. This policy defines acceptable impacts as those which will recover in one growing season. Under this principle, areas suffering severe campfire impact may be closed to campfires (USDA Eagle Cap Wilderness Management Plan, 1982). In a 1978 report to the Forest Service, Werner reported that Eagle Cap managers identified campfire impacts as "very important" concerns in the Lakes Basin area. Managers felt the limits of acceptable change had been surpassed (Werner, 1978).

To be valid and effective, management judgment should be based on input from a variety of sources. Of particular interest to wilderness managers in campfire policy determinations are the extent of resource damage, the perceptions and probable reactions of wilderness users, and the administrative practicality of a given policy decision. This information provides managers several forms of criteria on which to base a decision for managing campfire impacts in heavily used areas. The burden of proof should be on the need for campfire regulation.

RESEARCH DESIGN

Problem Statement and Objectives

The purpose of this study is to examine the potential for implementing a no-campfire policy in a heavily used portion of the Eagle Cap Wilderness.

This paper briefly reviews campfire management strategies; investigates the status of campfire restrictions in other select wildland areas; identifies visitor perceptions of campfires and their probable response to a campfire ban; and finally, discusses the management implications of these findings.

Study Area

The Ice Lake and Lakes Basin areas in the Eagle Cap Wilderness were selected for study. These areas were chosen because they represent an identifiable, contiguous, high-use area. Campfire impacts associated with heavy use are prevalent throughout this area.

The Eagle Cap Wilderness Area, the largest in Oregon, contains 293,735 acres of the Wallowa Mountains in northeastern Oregon (Figure 1). The Wallowas rise dramatically from the surrounding terrain forming an island of U-shaped valleys, forests, lakes, and rugged peaks. Elevation varies from 3,600 feet on the Minam River to 9,845 feet at the summit of Matterhorn Peak.

Most visitors are attracted to the more than 60 lakes dotting the subalpine zone. By far the most popular destination in the Eagle Cap Wilderness is an area of lakes called, for management purposes, the Lakes Basin Travel Zone. In 1980, over 14,000 visitors entered the Wilderness, and of this number, 22 percent ventured into this area (Bombaci, 1981). The study area encompasses this travel zone as well as adjacent Ice Lake Travel Zone, which is similar in terms of use and environment (Figure 2). The study area covers approximately 9,000 acres and is primarily characterized by alpine and subalpine plant communities (Figure 3). Coniferous forests occupy much of the area; dominated by subalpine fir (Abies lasiocarpa), in conjunction with Engelmann spruce (Picea engelmannii), lodgepole pine (Pinus contorta), and whitebark pine (Pinus albicaulis). The area

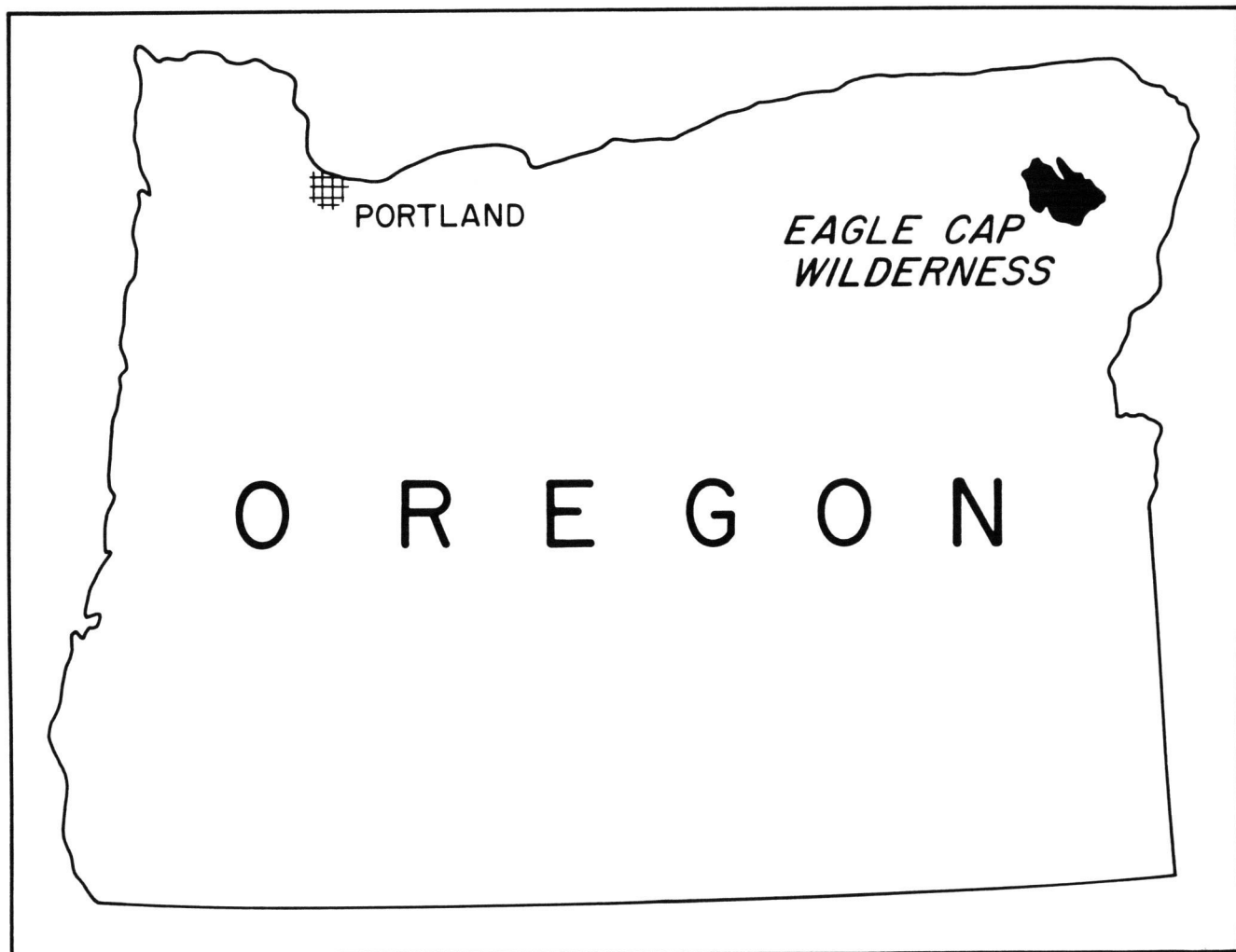


Figure 1. Location of Eagle Cap Wilderness in Oregon

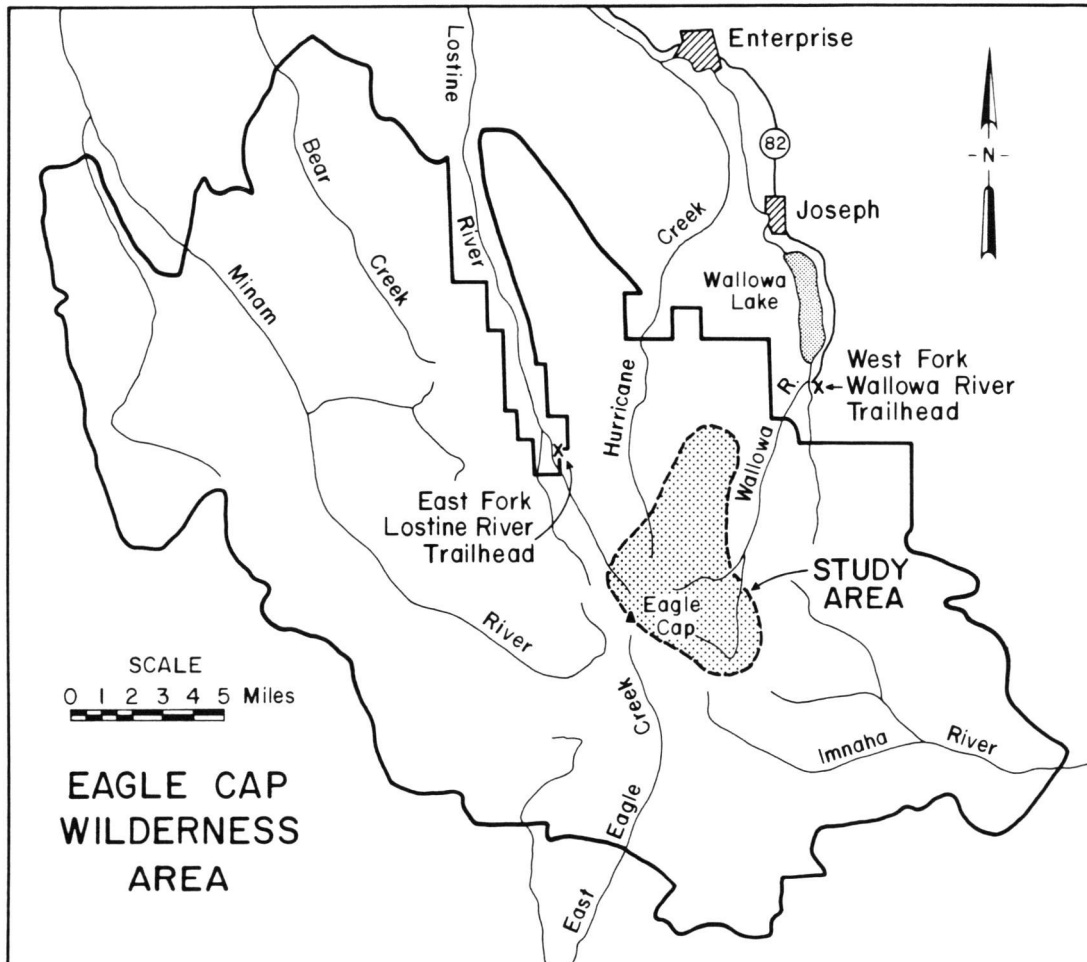


Figure 2. Location of Study Area in Eagle Cap Wilderness

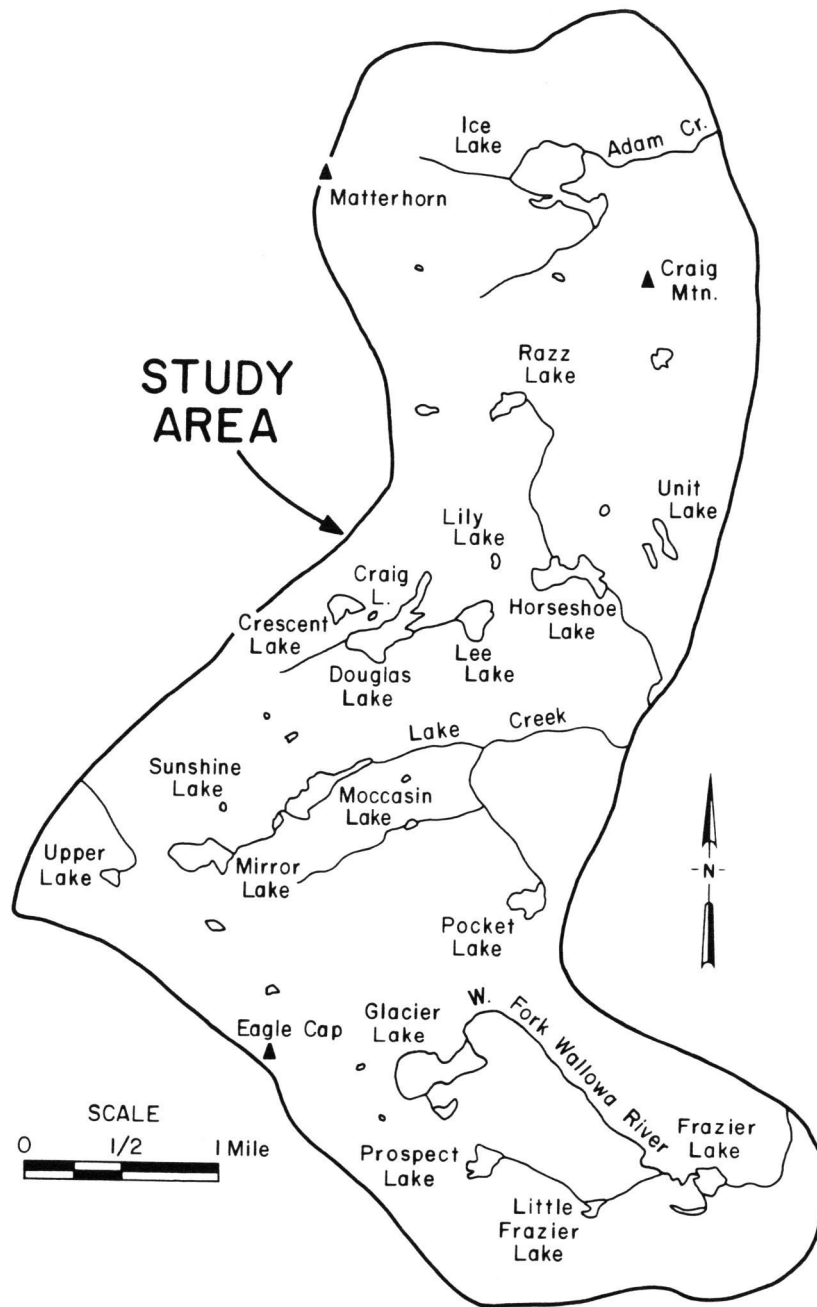


Figure 3. Study Area

contains 18 major lakes which range in elevation from 7,100 feet to 8,400 feet (Table 1).

Table 1. Lakes in the Study Area.

Lake	Elevation (ft.)	Lake	Elevation (ft.)
Ice	7,900	Moccasin	7,500
Razz	8,200	Sunshine	7,600
Unit	7,100	Mirror	7,600
Horseshoe	7,200	Upper	7,700
Lily	7,300	Pocket	8,200
Lee	7,200	Glacier	8,200
Craig	7,400	Prospect	8,400
Crescent	7,400	Little Frazier	7,500
Douglas	7,400	Frazier	7,100

Condition of the Study Area

In the Lakes Basin and Ice Lake Zones, Cole (1977) found that areas devoid of downed wood were at least 30,000m² in heavily used subalpine campsites. In a similar study, Cole (1982) found a typical campsite in the Eagle Cap Wilderness to have a camp area of 193m², a bare area of 87m²; with 90 percent of the mature trees scarred, mutilated, or felled. These results support the findings of the Code-A-Site campsite inventory on five lakes in the study area (Table 2). Most campsites in the study area have a serious resource problem, but according to available literature, Ice, Horseshoe, Moccasin, Mirror, and Glacier Lakes are particularly impacted (Call, 1977; Cole, 1977, 1981, 1982; Griffith, 1977; Werner, 1977). However, the extent and severity of campfire impact could be better documented by further ecological research.

Methods

Information was gathered from available literature on backcountry campfire management strategies, personal correspondence with managers from select wildland areas having campfire regulations, and a survey questionnaire

Table 2. Code-A-Site Data for Five Study Area Lakes

Lake Campsites	Campsite Impact from Previous Use				Campsite Firewood Availability			Total Fire Rings	Total Hacked Trees	Total Cut-down Trees
	Light %	Moderate %	Heavy %	Extreme %	Available %	Scarce %	None %			
Moccasin (N=40)	20	29	18	32	31	40	29	145	17	100
Mirror (N=206)	25	35	15	25	18	43	39	264	50	270
Horseshoe (N=40)	22	25	8	45	52	43	5	112	98	268
Lee (N=40)	37	38	13	14	100	0	0	21	5	9
Douglas (N=34)	24	35	9	32	88	12	0	72	36	59

Adapted from Griffith (1976-77). Table 2 is based on data from a Code-A-Site inventory of campsites around five lakes in the study area. (N equals the number of inventoried campsites at each lake.) See Hendee and others (1978) for an explanation of the Code-A-Site inventory.

administered to visitors of the Lakes Basin and Ice Lake Travel Zones. A letter was sent to managers of 14 areas having fire restrictions, soliciting their comments about the campfire policy in their area (Appendix A).

The questionnaire (Appendix B) was developed in consultation with the managers from the Eagle Cap Ranger District. It was designed as a management-oriented tool to survey users' attitudes toward campfires and their probable reaction to a campfire closure in the study area. The questionnaire was pre-tested in May, 1982 by an undergraduate class at Eastern Oregon State College.

The questionnaire was administered at two portal stations: West Fork Wallowa River and East Fork Lostine River (Figure 2). These trailheads provide primary access to the study area. The self-administered questionnaire was distributed to 313 persons returning from the study area. Respondents were at least 18 years old and had stayed overnight in the study area. The sampling period was from July 15 through September 5, 1982.

Characterization of the respondents was determined through descriptive statistics. For purposes of this study, a frequency analysis and subsequent cross-tabulations were used.

REVIEW OF CAMPFIRE MANAGEMENT STRATEGIES

Impacts associated with the gathering and burning of firewood vary among biotic communities, in conjunction with the amount and type of use the area receives. Research indicates that subalpine areas are subject to campfire impacts where use is moderate to heavy. But in those subalpine sites where use is low, campfire impacts are relatively insignificant (Cole, 1982). Cole and Dalle-Malle (1981) and Hammit (1982) suggest that most wildland areas would benefit from an "internal zoning system," dependent on the varying cir-

cumstances within an area. There are a number of campfire strategies available to managers (Table 3). These options fall along a regulation continuum ranging from indirect management techniques to more direct regulation. Such a system provides a spectrum of opportunities that support a balanced approach to backcountry campfire management.

Below is a listing of the range of methods considered to affect an improvement in the condition of campsites in the study area and why each was or was not deemed suitable:

1. No change from current management of the area. This alternative fails to recognize or address the fire-related impacts prevalent throughout the study area.
2. Information dispersal. Educating visitors on wilderness resource problems and low-impact camping techniques is helpful, but not effectively applicable to high-use areas as a solution in itself.
3. Elevational zoning. Not fully applicable to the problems in the area. However, the preferred option is, in effect, elevational in nature (i.e. subalpine zone). Some managers report poor success with this strategy because many backcountry users cannot read topographic maps.
4. No campfires allowed within $\frac{1}{4}$ or $\frac{1}{2}$ mile of any impacted study area lake. The ECW regulations already prohibit camping within 200 feet of any lakeshore with only moderate success. This method can be confusing to visitors from the standpoint that they must be aware of precisely which lakes are closed and how far $\frac{1}{4}$ or $\frac{1}{2}$ mile actually is. This type of campfire closure is difficult for the Forest Service to designate, sign, and patrol.
5. Restrict fires to designated and/or hardened sites. With this method, localized impacts are severe. Also, this option fails to address ongoing resource damage. Research suggests that most visitors want wilderness to be only minimally developed (Lucas, 1980).
6. Seasonal zoning. Closing the area to fires during the high-use summer months does not address the loss of standing live and dead trees, and picturesque snags. Deep snows generally prohibit access to dead and down wood in the winter months, rendering standing "wood" vulnerable to abuse.
7. Ration visitor use to the study area. This management strategy is a last-resort option and should be considered only when other alternatives have been explored first. Restricting people numbers

Table 3. Alternatives for Managing the Use of Campfires in Backcountry Areas.

Type of Management	Alternative	Specific Examples
INDIRECT	No Action	No campfire restrictions.
	Information Dispersal	Promote desired campfire policies. Educate users of fire impacts.
	Elevational Zoning	Restrict fires above treeline and in adjacent alpine plant communities.
	Forest Type & Site Zoning	Restrict fires to a certain distance from impacted areas (i.e. $\frac{1}{4}$ mi. from high-use lakes). Restrict fires from forest types that lack firewood (i.e. subalpine fir forest). Restrict fires from non-forested areas (i.e. meadow communities). Restrict fires by specific sites that lack firewood. Restrict fires to designated sites where firewood is plentiful.
	Temporal Zoning	Restrict fires to darkness hours only. Require stoves for cooking.
	Seasonal Zoning	Restrict fires to winter and cool weather seasons.
	Communal Fires	Require several parties to share a common fire.
	Rationing	Ration campfires to $\frac{1}{4}$ or $\frac{1}{2}$ of the nights camped by a party. Ration visitor use.
DIRECT	Total Ban	Eliminate fires on a backcountry-wide basis.

Adapted from Hammit (1982).

may be necessary in the future, but its investigation is beyond the scope of this study.

8. Eliminate campfires from the study area. This is the chosen strategy. See below.

Of the campfire management strategies available, a fire closure is considered the most acceptable option for the Lakes Basin and Ice Lake study area (i.e. Forest Type and Site Zoning alternative). This strategy is most compatible with Forest Service wilderness management objectives. An all-area-inclusive closure would be easy to designate on a map for visitors, relatively easy to sign and patrol, and would provide less opportunity for confusion as to where fires are or are not allowed. This option protects all high-elevation lakes in the most heavily used section of the Wilderness. All of these lakes suffer from resource damage associated with the use of fire. Lastly, a no-campfire prohibition is the most effective strategy from a resource rehabilitation perspective. Mackie (1982) estimates that impacts in camp areas could be reduced by 75 percent if visitors were prohibited from building wood fires.

SURVEY RESULTS

The results of the study are organized into two sections. First, a narrative description of campfire restrictions and managerial comments from 14 backcountry areas are presented. Second, the data from the questionnaire are described to document visitor perceptions and attitudes about campfires and campfire prohibitions. (A sample of the questions may be found in Appendix B). Much of the data in this section are presented in tables using percentages. In those incidences where percentages add up to more than 100 percent, it means that a respondent could have checked more than one answer. All relationships presented between variables are statistically significant at the 0.05 level.

Attitudes, Perceptions, and Preferences of Wilderness Campfires

Wildland Manager Views

Background. Approximately 15 percent of all wilderness and backcountry areas prohibit campfires. Many others permit fires but restrict or prohibit them in certain zones. Of those that permit fires, 79 percent have no restrictions on campfire use (Cole and Dalle-Malle, 1981).

Managers from 14 Forest Service and Park Service areas (where fire restrictions are in effect) were contacted and asked to comment on the campfire policy in their area. (A copy of the manager survey letter may be found in Appendix A). For the most part, these areas have zones similar in use and environment to the study area. The results of the survey reveal information about the successes and failures of campfire prohibitions, and provide insight to managers attitudes and preferences toward campfire management.

All areas, except one, use a Forest Type or Site Zoning strategy to manage campfires. Only the Denali Wilderness in Denali National Park and Preserve has a total campfire ban; eliminating fires from the wilderness portion of the park. Of the remaining 13 areas, all employ one or more of the following restrictions: ten (77%) prohibit fires in high-use lake areas; three (23%) restrict fires from a specific lake, stream, or meadow; and five (38%) limit fires to designated sites throughout the backcountry. Four areas use one of the above methods in conjunction with elevational zoning, and one area limits its fire prohibition to the high-use summer season (Table 4). Some managers feel elevational zoning is too nebulous because most visitors cannot read a topographic map.

Table 4. Campfire Management in 14 Wildland Areas.

Name	Elevational Zoning	Forest Type & Site Zoning	Seasonal Zoning	Total Ban
USDA Forest Service (Wilderness)				
Absaroka-Beartooth		x		
Alpine Lakes		x		
Bridger		x	x	
Inyo Nat'l Forest		x		
Mount Hood		x		
San Geronio		x		
Sawtooth		x		
Three Sisters		x		
USDI Park Service (Wilderness and backcountry)				
Denali				x
Glacier		x		
Grand Teton	x	x		
Mount Ranier	x	x		
Olympic	x	x		
Yosemite	x	x		

All managers indicated that accelerated resource degradation, and/or prevention of resource deterioration, was the principal reason for implementing fire restrictions. Only four areas indicated that their decision was based on formal social or ecological research. Others based their decisions on informal field studies of wood availability, destruction of snags, damage to live trees, and associated campfire related impacts. Regardless of whether the analysis was quantitative or informal in nature, support for campfire restrictions was nearly unanimous among managers. Most managers see no way that large numbers of fires can be permitted in wildland areas without seriously altering visual and ecological resources. Over one-half of the respondents foresee a need for additional fire restrictions in the future. Only the Absaroka-Beartooth Wilderness plans to re-open restricted campfire areas to limited use when the damaged sites recover.

Ten managers (71%) cited good to excellent public support and compliance of the fire policy in their respective area. The remaining four (29%) felt public response was positive but compliance only fair. Most managers actively enforce their policies, but are becoming increasingly concerned over reduced budgets and backcountry staffs. Currently, two wildland areas rely exclusively on voluntary visitor compliance because of a lack of funding for adequate backcountry patrols. As a result, compliance rates usually drop. Most managers report that visitor education is the preferred enforcement tool, and resort to prosecution only with blatant and "habitual" offenders. Several managers indicated peer pressure to be an effective deterrent that helps significantly with the enforcement program.

Of concern to backcountry managers are the ramifications of a policy change in relation to visitor use patterns. Are campfires so popular that their prohibition will channel campfire "refugees" into areas where fires are allowed? This is a critical question for areas adjacent to closure zones that are just barely meeting limits of acceptable change with their current levels of use. Twelve respondents (86%) reported little or no shift in use patterns as a result of their campfire policy. Two managers indicated there had been a significant shift in use away from the restricted area, but only one thought it was cause for concern.

Overwhelmingly, managers reported that campfire restrictions have helped the wilderness resource, from both a visual and ecological perspective. Campsites are generally much cleaner and less noticeable than before the prohibition. Sites still look well used, but the everpresent fire rings, charcoal and ashes, and litter; the general mess associated with fires, are absent. The reduction of tree mutilations is another important improvement.

In areas that have had fire prohibitions in effect for ten years or more, noticeable natural recovery is occurring in subalpine meadows. Recovery is less obvious on forested sites. In Mount Ranier National Park, recovery of monitored meadow fire sites had less than 10 percent vegetation cover naturally restored after 13 years of site closure (Dalle-Malle, 1982). It will be many years before old fire scars are completely restored. Even when assisted, campfire site recovery in subalpine areas may take at least 10 to 15 years (Cole and Dalle-Malle, 1981). Three of the areas surveyed have active rehabilitation programs.

Managers report that, in general, most backcountry visitors carry cookstoves, accept the concept of low-impact camping, and comply with regulations when there is solid evidence to justify their need. Many managers feel that total or partial fire closures have been a positive management step in reducing campfire impacts. Some respondents indicated that by prohibiting fires in certain zones, they have been able to avoid resorting to more regulatory policies, such as rationing visitor use. In effect, without fires, campsite impacts are reduced and, thus, more people can experience the backcountry.

Study Area Visitor Opinions (questionnaire analysis)

This section begins with a brief description of study area visitor characteristics, notably place of residence and method of travel in the wilderness. This data can help identify differences of opinions about campfires among user groups. By knowing where people live and their preferred travel mode, managers can better plan wilderness education programs.

Residence. Ninety-eight percent of the visitors to the study area resided in the Pacific Northwest. The areas with the largest representation were the regional area (43%) and the Willamette Valley (32%),

particularly the Portland area. Local counties were under-represented, accounting for only 5 percent of the visitors to the study area (see Table 5). This probably confirms the general notion that locals avoid the heavily used Lakes Basin area. Werner (1977) found that only 4 percent of overnight use in this area was by local residents. The study area findings from the campfire survey are analogous with 1978-80 Eagle Cap Wilderness permit data. In contrast, the 1978-80 permit data show that residents from the surrounding local counties accounted for 29 percent of the total use for the wilderness area.

Table 5. Residence of Study Area Visitors. (N=313)

Place of Residence*	Percentage
Local Counties	5
Regional Area	43
Metropolitan Area	28
Other Pacific Northwest	22
Other USA	2

*The five residence regions are composed of the following areas:

Local Counties: Baker, Union, and Wallowa counties.

Regional Area: Within 200 air miles of Enterprise, Or; excluding local counties; including Spokane, WA and Boise, ID.

Metropolitan Area: S.M.S.A.'s with populations greater than 500,000. The Portland area accounts for 22% of this figure.

Other PNW: All other Oregon, Washington and Idaho areas.

Other USA: All other non-S.M.S.A.'s outside the Pacific Northwest.

Method of Travel. Backpackers accounted for 96 percent of the use in the study area, far outnumbering horsepackers (3%) and individuals hiking with packstock (1%). Generally speaking, foot travel constitutes about 75 percent of all use in the Eagle Cap Wilderness; horse travel makes up the remaining 25 percent (Bombaci, 1981). The majority of the horse use takes place during the fall hunting seasons.

Campsite Location and Length of Stay. Visitors were asked to identify near which lake in the study area they camped most of the time. As expected, Mirror Lake was by far the most popular camping area, accounting for 37 percent of the overnight use. This was followed by Ice, Moccasin, and Horseshoe Lakes respectively (Table 6). Use appears to coincide closely with degree of fire-related impact. The average length of stay was 3 days. Werner (1977) found similar results on both counts in a survey of visitor characteristics of the Lakes Basin.

Table 6. Campsite Location. (N=293)

Lake	Percentage
Mirror	37
Ice	18
Moccasin	15
Horseshoe	14
Douglas	5
Glacier	4
Frazier	1
Other	6

Campfire Preferences and Perceptions. Not surprisingly, campfires were built by a vast majority of the respondents. Only 16 percent never built fires (Table 7).

Table 7. Frequency of Campfires. (N=313)

Frequency	Percentage
Every Day	57
Some Days	27
Never	16

In general, place of residence has little bearing on whether or not people build fires. Ninety-four percent of all local campers had fires

and 80 percent of the campers from metropolitan areas also built fires (Table 8).

Table 8. Campfires by Place of Residence. (N=313)

Campfire	Residence				
	Local Counties	Regional Area	Metropolitan Area	Other PNW	Other USA
Yes	94	86	80	85	86
No	6	14	20	15	14

Those who built fires did so for both esthetic and utilitarian reasons. Warmth was chosen by 76 percent of the fire builders, followed by cooking, and atmosphere (Table 9).

Table 9. Reasons for Building Campfires. (N=264)

Reasons	Percentage
Warmth	76
Cooking	50
Atmosphere	48
Light	27
Companionship	20
Repel Mosquitos	11
Security	3
Burn Garbage	3

Fire builders were asked to estimate the distance they had to travel from their camp to find firewood (Table 10). Seventy-nine percent of the respondents found wood supplies within 300 feet of their campsite. Only 21 percent felt they traveled more than 300 feet to find firewood.

Table 10. Distance from Campsite to Firewood. (N=264)

Distance	Percentage
On the Campsite	15
Less than 100 Feet	33
100 Feet - 300 Feet	31
300 Feet - $\frac{1}{4}$ Mile	16
More than $\frac{1}{4}$ Mile	5

Of those individuals that walked more than $\frac{1}{4}$ mile to find firewood, almost all (92%) stayed near the highest use lakes. Forty-two percent camped Mirror Lake, and 25 percent camped Moccasin and Ice Lakes respectively. Interestingly, 77 percent of all campers did not perceive there to be a lack of firewood (downed wood) where they camped. Studies suggest that visitors perception of campsite impacts is limited (Lucas, 1979).

Sixteen percent of all campers chose not to build a fire on their visit to the study area. The two reasons chosen most frequently were that they brought a stove for cooking, and they prefer not to build campfires in heavily used areas (Table 11).

Table 11. Reasons for not Building Campfires. (N=49)

Reasons	Percentage
Brought a Stove for Cooking	86
Prefer not to Build Campfires in Heavily Used Areas	55
Don't Like Fires	18
Firewood was too Hard to Find	14

Of those campers that had no fire, their perception of available firewood was almost evenly divided. Forty-six percent believed there was a lack of available wood supplies whereas 54 percent did not. Perceived firewood scarcity was apparently proportional to the distance fire builders traveled to gather wood (Table 12).

Table 12. Perceived Lack of Firewood by Distance from Campsite to Firewood. (N=292)

Firewood	Distance					
	No Campfire	More than $\frac{1}{4}$ Mile	300 Ft.- $\frac{1}{4}$ Mile	100 Ft.- 300 Ft.	Less than 100 Ft.	On the Campsite
Yes	46	54	35	19	11	10
No	54	46	65	81	89	90

Missing cases: 21

Use of Stoves. Eighty-five percent of all visitors to the study area carried a small cookstove with them. Werner (1977) found that 92 percent of all Lakes Basin campers carried stoves. Similarly, Buskirk (1976), in a survey of Mount McKinley backpackers, found that 86 percent had stoves. In a study of nine backcountry areas, Lucas (1980) found that many overnight visitors used stoves for cooking; and built fires for warmth and atmosphere. Of the study area campers that had stoves, 81 percent built a fire at some point on their trip.

Campfire Desirability. Overall, 66 percent of the respondents consider a wilderness campfire to be desirable or very desirable. Only 10 percent feel campfires are undesirable or very undesirable (Table 13). In general, there is some evidence to suggest that campfire desirability preferences may be influenced, at least in part, by place of residence. Eighty-eight percent of the campers from the local (rural) area consider fires to be desirable or very desirable, compared to 60 percent of the visitors from metropolitan areas. However, most campers, regardless of where they live, consider building fires to be an important, if only symbolic, part of the backcountry experience.

Table 13. Preference for Campfires in Wilderness. (N=309)

Desirability	Percentage
Very Desirable	31
Desirable	35
Neutral	24
Undesirable	6
Very Undesirable	4

Campfire Policy Support. One of the most important questions to back-country managers in campfire policy determinations, is the amount of public support for a fire prohibition. Visitors to the Lakes Basin and Ice Lake Travel Zones were asked if they would support a policy prohibiting campfires if resource damage was occurring. Eighty-nine percent of the respondents favor a fire restriction if it is necessary to protect wilderness resources. Not many wilderness users would knowingly support resource degradation. However, 11 percent were opposed to a fire prohibition (Table 14). Mistrust of Forest Service judgment, or motives, may be the reasoning for some of the dissension.

Table 14. Support of Campfire Prohibition Policy. (N=310)

Support	Percentage
Yes	89
No	11

In the Denali Wilderness, where a total campfire ban is in effect, a 1978 research survey of 3000 backpackers found that 75 percent supported the policy (Womble, 1979). Lucas (1980), however, found that overnight visitors to nine wilderness areas opposed the concept of campfire prohibitions by nearly two to one. In general, though, wilderness visitors accept

and comply with regulations when the problem is evident or well-explained (Lucas, 1979).

There was virtually no difference between those who support a policy prohibition and those who do not, and their perception of a lack of firewood (Table 15).

Table 15. Perception of Firewood Scarcity by Support of Campfire Prohibition Policy. (N=295)

Firewood Scarcity	Policy Support	
	Yes	No
Yes	91%	9%
No	88%	12%

Missing cases: 18

Regardless of visitor perception of firewood scarcity, most respondents support a campfire prohibition.

Sixty-four percent of those that support a campfire prohibition policy feel a fire is desirable or very desirable, and 82 percent of the non-supporters feel the same way (Table 16).

Table 16. Support of Campfire Prohibition by Preference for Wilderness Campfires. (N=306)

Policy Support	Preference				
	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable
Yes	28%	36%	25%	7%	4%
No	55%	27%	12%	3%	3%

Missing cases: 7

Further, place of residence appears to have little effect on the tendency to support a campfire prohibition. The majority of all visitors were supportive, regardless of where they lived. The least support came from local residents with 79 percent backing a fire regulation, followed by regional (89%), metropolitan (90%), other Pacific Northwest (91%), and other USA (100%) residents.

Looking at policy support and method of travel, a different pattern emerges. Ninety-one percent of all study area backpackers support a fire prohibition, in contrast to 57 percent of the horsepackers and 33 percent of those hiking with packstock. It should be pointed out, however, that the latter two travel modes were grossly under-represented in the survey and no attitudinal inferences should be based on this data. Although many managers do regard horsepackers to be less tolerant of backcountry regulations than backpackers (Hendee, Stankey, Lucas, 1978).

Visitor Response to Prohibition. Equally important to managers are the probable reactions of backcountry visitors to regulatory restrictions. Study area visitors were asked what effect a campfire closure of the Lakes Basin and Ice Lake Travel Zones would have on their future visits to the Eagle Cap Wilderness (ECW). Eighty-eight percent of all respondents indicated that it would not affect their visits in any way. Ten percent indicated they would avoid the closure area, and another 2 percent would discontinue visiting the Wilderness altogether (Table 17).

Table 17. Effect of Campfire Policy on Visitation. (N=313)

Effect	Percentage
Visit all Areas and Build Fires in Accordance with the Policies Established for Each Area.	88
Avoid Restricted Areas and Visit only Parts of the Wilderness where Campfires are Permitted.	10
Discontinue Visiting the Eagle Cap Wilderness.	2

Interestingly, 67 percent of the people that do not support a fire prohibition would continue to visit all areas of the Eagle Cap, regardless of a fire ban (Table 18).

Table 18. Support of Campfire Prohibition by Effect of Campfire Policy on Visitation. (N=309)

Policy Support	Policy Effect		
	Visit all ECW	Visit ECW but Avoid Study Area	Avoid ECW Entirely
Yes	91%	8%	1%
No	67%	21%	12%
Missing cases: 4			

Also, 76 percent of those campers that said they would avoid the study area as a result of a campfire prohibition support the restriction. Of the respondents who indicated they would avoid the wilderness altogether, one-third support a fire prohibition. It would appear that some people philosophically agree with regulations when they are necessary to protect wilderness values, but prefer to avoid these restrictions while personally visiting wildland areas. In Yosemite National Park, where campfire restrictions are in effect, managers have found there is very good public support for the policy, but only fair backcountry compliance (Mackie, 1982). While visitors may agree with campfire policies, they may have a difficult time relating to them in the backcountry. In Denali National Park, Womble (1979) found that some hikers support the Park Service's regulations, but continue to violate some of them. Hence, it is important for managers to consider that what people say and what they do are often contradictory. In other

words, Eagle Cap managers might expect poorer compliance than implied by the survey.

And finally, visitors were asked if they had any additional comments about campfires. The majority of respondents preferred not to answer this open-ended question. Many that did, used the opportunity as a general complaint session. Of future interest to Eagle Cap managers, thirty-five respondents (11%) wrote negative comments about horse use in the Lakes Basin and Ice Lake zones. On a humorous note, one clever individual suggested that the Forest Service prohibit wood fires and ask campers to burn horse dung.

DISCUSSION

Summary

The effects of campfire use in heavily used subalpine areas are significant. Studies by Cole, and Forest Service Code-A-Site reports, as well as wilderness staff observations, suggest that impacts associated with gathering and burning wood are prevalent throughout the Lakes Basin and Ice Lake Travel Zones. Some campsites are more impacted than others, but essentially all sites show some evidence of fire-related damage.

Most backcountry areas could benefit from the implementation of an internal campfire zoning system, based on management objectives and the degree of impact and use. A spectrum of campfire management alternatives exists from which managers may choose the most appropriate strategy for a given zone. In many cases, prohibition of all campfires may be the best choice. This is the most legitimate option for the study area.

Overall, there are similarities as well as differences among managers' and visitors' perceptions of wilderness campfires. The perception of

fire-related impacts and the desirability standards of campfires probably differ most between the two groups. Not surprisingly, managers are much more aware of environmental impacts, and place greater importance on preserving the integrity of wilderness resources. It is clear, however, that managers and visitors alike, have a vested interest in protecting back-country areas. Though their motives may differ, there is overwhelming support from managers and visitors for campfire restrictions. Education can increase visitor awareness of resource impacts, policy goals, and the legal constraints of wilderness.

Implications for Management

Research indicates that most changes on campsites occur with only light use (Cole, 1981d). Consequently, some impacts from recreational use are inevitable. Wherever people camp, trampling of vegetation and loss of ground cover and duff are inescapable.

Perhaps more important than amount of use, is type of use. Use of wood fires dramatically increases the size of the impacted area around campsites. Fire scars, depletion of firewood in the vicinity of campsites, mutilation of standing trees, and other impacts associated with fire use are not ineluctable campsite changes. Over many years, in popular sub-alpine areas, campsite deterioration resulting from gathering and burning wood can exceed established limits of acceptable change. Wilderness managers have the responsibility to protect the integrity of the resource and experience into perpetuity. There is evidence to suggest that the use of campfires in the heavily used Lakes Basin and Ice Lake Travel Zones may be in conflict with that objective. Prohibition of wood fires can substantially reduce campsite impacts by conserving nutritional sources in the immediate vicinity of the campsite, and eliminate trampling that results from the

search for firewood, as well as abrogating the more obvious fire-related wilderness blemishes (Cole and Dalle-Malle, 1981).

Wilderness campfire management calls for careful analysis of the feasibility and effectiveness of the available management techniques. Indirect approaches (i.e. visitor education) are preferable, but in the case of this study, have been ineffective in alleviating campfire impacts in the Lakes Basin and Ice Lake areas. No direct-management campfire regulation is a panacea. To the contrary, restrictions on visitor behavior make backcountry management a more challenging task, especially in terms of law enforcement and administrative costs.

A management decision about a campfire closure in the study area should be based on several criteria: 1) the legal and policy goals that set standards for acceptable impact levels; 2) the extent of campfire-related resource damage; 3) an understanding of visitor opinions relating to campfires; 4) the practicality of the chosen campfire management strategy; and 5) administrative costs. This study has addressed the former four points. First, Forest Service direction for wilderness areas specifically states that management should accept the principle of nondegradation, rendering campfire impacts unacceptable if they are unable to recover naturally in one growing season. Second, an analysis of available literature indicates that campsite deterioration in the study area is influenced significantly by activities related to building campfires, probably beyond the limits of acceptable change. Unquestionably, environmental quality of the area would benefit considerably by a fire ban. Third, while visitor satisfaction may not be strongly affected by the severity of campsite impacts, users should actively concern themselves with wildland resource problems. A survey of visitor attitudes and preferences shows overwhelming support for a campfire

prohibition, and indicates that no major negative ramifications relating to visitor use should be expected. Fourth, a no-campfire policy is the most popular and successful campfire management strategy. It is the method least confusing to the public. It is relatively easy to designate and administer, and produces the best resource rehabilitation results.

This study has addressed the feasibility and effectiveness of a no-campfire policy for the Lakes Basin and Ice Lake Travel Zones. Before adopting a new policy, Eagle Cap managers must determine the financial costs of implementing a prohibition on such a popular camping activity. Regulations are not self-enforcing and a regulation is only as good as its compliance, and hence, its enforcement. Without adequate backcountry patrols, visitor compliance can be expected to be only fair at best, thus defeating the purpose of fire closure. In this era of wilderness management budgetary constraints, this is an important concern.

Finally, a prohibition of campfires from the study area will require dispersing information about the closure to wilderness users. At least a one-year lag time is recommended to adequately perform a quality public information campaign, as well as prepare wilderness staff for a policy change.

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APPENDICES

Appendix A

Manager Survey Letter

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

38

Eagle Cap Ranger District
P.O. Box M, Enterprise, Oregon 97828

April 21, 1982
2320

Tom Alt
Wilderness Manager
Beartooth Ranger District
Custer National Forest
Red Lodge, MT. 59068



Dear Tom:

The Eagle Cap Wilderness, like so many wilderness areas, contains established high-use areas. By far the most popular destination is an area of lakes called, for management purposes, the Lake Basin Travel Zone. Recreational impacts associated with overuse are prevalent throughout this area. The dwindling wood and nutrient supply which is resulting from the continual gathering and burning of scarce firewood is an impact of increasing concern. Based on current campfire impact research, and resource inventories conducted in the Lake Basin Travel Zone, we would like to investigate the feasibility of implementing a new campfire policy in this popular area.

Of special consideration in our investigation are wilderness areas which have implemented campfire restrictions. Please take a few minutes and jot down your comments on the campfire policy in your area. We are especially interested in the following information:

1. Background and Implementation

What is the campfire policy in the Absaroka-Beartooth Wilderness?

Why is the restriction necessary?

Were any formal or informal studies (i.e., wood production, visitor perceptions, etc.) conducted prior to, or after, implementing the campfire restriction?

How was the visitor informed (i.e., advance publicity, signing, etc.) of the restriction?

2. Public Response

Has there been good public understanding and support for this action?

What effect has the campfire restriction had on the visitor?

Has there been a shift in use patterns as a result of the restriction? (For example, from restricted to open campfire areas.) If so, has this increased resource deterioration in these "new" areas?

3. The Resource

What effect has the restriction had on the restricted area?

Has the area noticeably recovered since the restriction was implemented?

Have you set an exact distance back away from the impacted area, or is an entire area, such as a lake basin, restricted from campfires?

4. Law Enforcement

Has visitor compliance been a problem?

Do you actively enforce the restriction?

5. Future Plans

Do you plan to expand campfire restrictions to other heavily impacted areas, or implement restrictions to protect areas from potential campfire impacts?

Do you plan to lessen restrictions where recovery of the resource has been successful?

Overall, are you satisfied with the campfire restriction(s) in your area?

Any other advice, suggestions, or information you may have concerning campfire policies and/or impacts will be appreciated. In conclusion, we welcome comments from wilderness rangers who are familiar with the implementation of and reaction to the campfire policy in the Absaroka-Beartooth Wilderness.

The above list is not meant to be all inclusive, but to give you an idea of the type of information we would find useful. We plan to use your comments to help shape a management decision regarding campfire impacts in the Eagle Cap Wilderness. Thus, your response will be greatly appreciated.

Thank you for your time. I look forward to hearing from you soon.

Sincerely,

for Taylor Orr
TOM GLASSFORD
Wilderness Manager

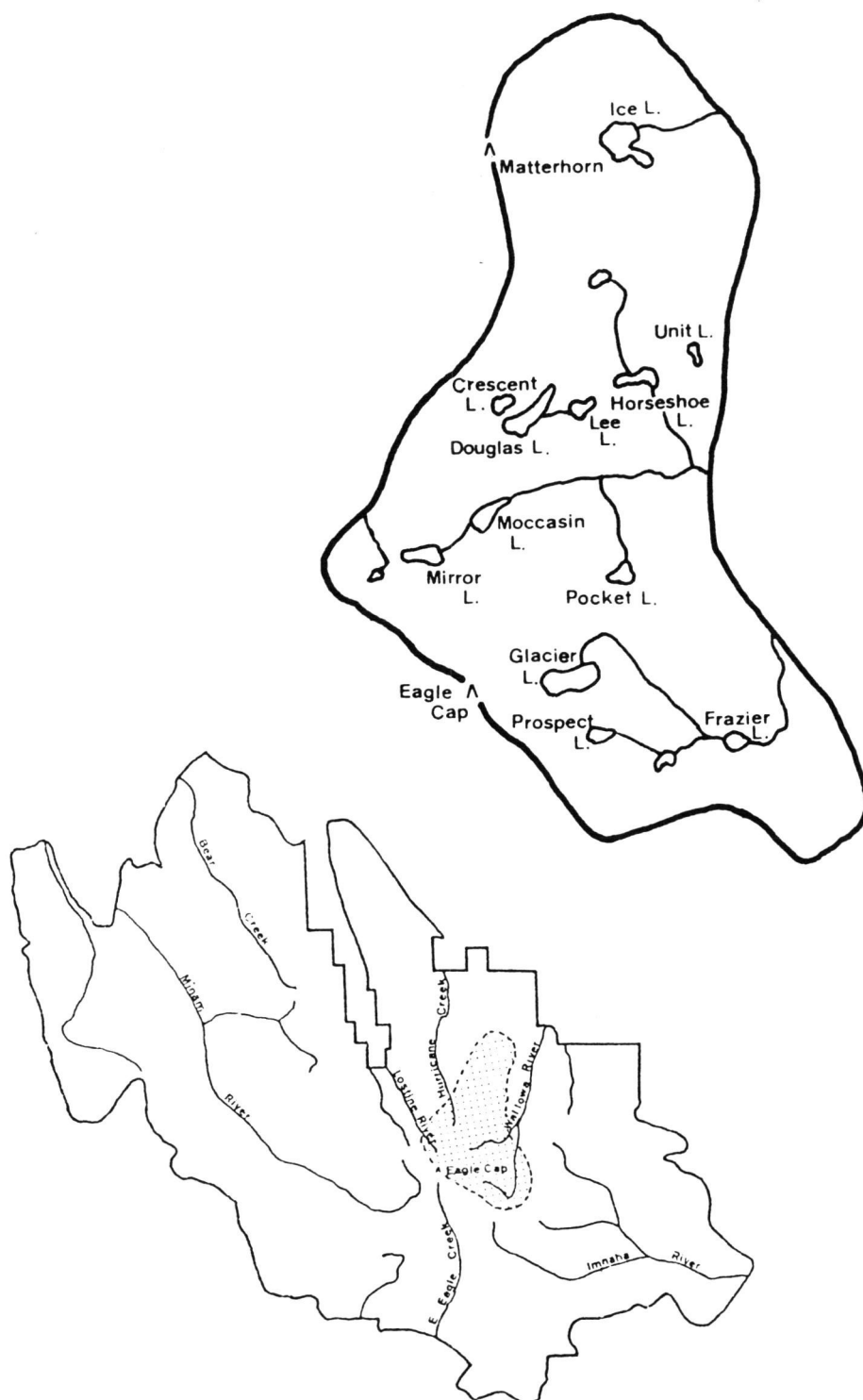
Appendix B

Wilderness Campfire Questionnaire

Wilderness Campfire Study



STUDY AREA



CAMPFIRE QUESTIONNAIRE

We would appreciate your help in a research project sponsored by Oregon State University in cooperation with the U.S. Forest Service, regarding campfire policies in a heavily used portion of the Eagle Cap Wilderness.

The Lake Basin and Ice Lake Travel Zones (see map of the Study Area) are popular destinations in the Eagle Cap Wilderness. Campfire impacts associated with heavy use are prevalent throughout this area. The information you can furnish from your visit to the Study Area will help the Forest Service shape future management plans for this part of the wilderness.

Please complete the questionnaire only if you are 18 years old or over, and if you stayed overnight in the Study Area during your last visit to the wilderness.

If you would like a summary of the results of this study, please print your name and address on the back of your questionnaire. All of your answers to the questions will remain strictly confidential.

Thank you for your assistance on this project. Your opinions do count!

Department of Resource Geography
Oregon State University
Corvallis, Oregon 97331

1. Near which lake in the Study Area did you camp most of the time? (Check only one box.)

☐ MIRROR
☐ MOCCASIN
☐ DOUGLAS
☐ HORSESHOE

☐ FRAZIER
☐ GLACIER
☐ ICE
☐ OTHER _____

2. How many days did you camp in the Study Area?

_____ DAYS

3. How often did you build a campfire in the Study Area?

☐ EVERY DAY
☐ SOME OF THE DAYS
☐ NEVER

4. If you built a campfire, why did you do so? (Check all boxes that apply.)

☐ WARMTH
☐ COOKING
☐ LIGHT

☐ ATMOSPHERE
☐ COMPANIONSHIP
☐ SECURITY

☐ OTHER _____

5. How far from your campsite did you have to walk to find firewood? (Check only one box.)

☐ MORE THAN $\frac{1}{4}$ MILE
☐ BETWEEN 300 FEET AND $\frac{1}{4}$ MILE
☐ BETWEEN 100 FEET AND 300 FEET
☐ LESS THAN 100 FEET BUT OFF THE CAMPSITE
☐ ON THE CAMPSITE

6. If you did not build a campfire, why not? (Check all boxes that apply.)

☐ I PREFER NOT TO BUILD CAMPFIRES IN HEAVILY USED AREAS.
☐ I BROUGHT A STOVE FOR COOKING.
☐ FIREWOOD WAS TOO HARD TO FIND.
☐ I DON'T LIKE FIRES.
☐ OTHER REASONS _____

7. Did you have a small camp cookstove along on your trip?

☐ YES ☐ NO

8. Do you feel that there was a lack of available firewood (downed wood) where you camped?

☐ YES ☐ NO

9. How desirable or undesirable do you consider a campfire when you camp in the wilderness? (Check only one box.)

☐ VERY DESIRABLE
☐ DESIRABLE
☐ NEUTRAL
☐ UNDESIRABLE
☐ VERY UNDESIRABLE

10. If resource damage was occurring as a result of gathering and burning firewood, would you support a policy prohibiting campfires in the damaged area?

☐ YES ☐ NO

11. If campfires were prohibited within the Lake Basin and Ice Lake areas how would this policy affect your future visits to the Eagle Cap Wilderness? (Check only one box.)

() I WOULD CONTINUE TO VISIT THESE AREAS AND BUILD NO CAMPFIRES.

() I WOULD AVOID THESE AREAS AND VISIT ONLY PARTS OF THE WILDERNESS WHERE I COULD BUILD CAMPFIRES.

() I WOULD CONTINUE TO VISIT ALL AREAS OF THE WILDERNESS AND BUILD CAMPFIRES IN ACCORDANCE WITH THE POLICIES ESTABLISHED FOR EACH AREA.

() I WOULD DISCONTINUE VISITING THE EAGLE CAP WILDERNESS.

12. Where do you live?

TOWN OR CITY

STATE

13. How did you travel in the wilderness?

() BACKPACKING

() HIKING WITH PACKSTOCK

() HORSEPACKING

14. Do you have any additional remarks that you feel the Forest Service should consider in establishing campfire policies for heavily used camping areas in wilderness?

--THANK YOU--