

# A Literature Review



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WILDERNESS MANAGEMENT

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### THE WILDERNESS RESOURCE

Wilderness in the United States is defined by the Wilderness Act of 1964 (Public Law 88-577). Our focus in this paper is on wilderness as a recreation resource, although the Wilderness Act makes it clear that a wilderness is not primarily a recreation area. Rather, the overriding goal is providing places where natural processes operate with minimal interference from man's activities. Recreation is important in almost all wildernesses, and is the major management challenge in most, but legally it should be a special type of experience featuring "outstanding opportunities for solitude or a primitive and unconfined type of recreation," and not threaten perpetuation of wilderness conditions.

The National Wilderness System contains 445 separate areas, totaling almost 89 million acres as we enter 1986. Most of the acreage (over 56 million acres) is in Alaska, but most of the individual areas (400) are in 43 other States. Although all but six States now have wilderness, most of the system is in the West.

The Wilderness System has grown greatly since passage of the Wilderness Act. In 1964, there were only 54 wildernesses totaling about 9 million acres. In 1980, over 61 million acres were added, and in 1984, 223 areas and more than 8 million additional acres entered the system. Wilderness management has changed from an activity involving only a few public land managers to a major responsibility of many.

### SUMMARY OF FINDINGS

This overview is brief. Detailed reviews of the state of knowledge for all major wilderness research topics were presented at the National Wilderness Research Conference held at Colorado State University in July 1985. These will be published later in 1986 (Lucas in press b). Other papers in the National Resources Management section of this volume deal with related topics--carrying capacity (Stankey and Manning), resource impacts caused by recreation (Cole), and recreation trails (Krumpe and Lucas). Therefore these topics will not be discussed in detail here.

Wilderness concerns include both allocation and management. Allocation, or designation of certain lands as wilderness, is largely a political process, with only limited research involvement. Management is mainly professional and technical, and it is the focus of most wilderness research. Managing wilderness resources is largely a matter of managing use, mainly recreational use, to protect resources and provide visitors opportunities for quality wilderness experiences (Lucas 1973). Thus, understanding visitors is basic to wilderness management.

### Recreation Use and Users

Research provides a partial picture of wilderness recreation use and users, although most wildernesses have never been studied, and some regions of the country are unstudied.

Patterns of use vary more among areas than do user characteristics (Hendee and others 1978; Lucas 1980; Roggenbuck and Lucas in press). The size and character of individual wildernesses influence the type of use they receive. In general, wilderness visits are short. Small- to medium-sized wildernesses usually are visited by more day users than campers, while in large areas stays average 5 or 6 days. Hiking is the most common method of travel almost everywhere, especially outside the Rocky Mountains, where most horse use is concentrated. The most heavily visited of all wildernesses, however, is the Boundary Waters Canoe Area Wilderness in Minnesota, where almost all travel is by canoe or boat.

Visitors engage in a variety of activities. Hiking, fishing, and, photography are usually the top three, and generally involve a majority of visitors. Nature study is usually next. Hunting varies among areas, from common to almost none. Most visitors come in small parties. Two-person groups are most common, and four-person groups are usually next most common. Lone individuals and parties over 10 are usually scarce. Summer is the main use season most places, although desert wilderness and some southern areas have peak use in the spring. The degree of weekend use peaking varies among areas, and probably is less pronounced now than earlier.

Wilderness recreational use is very unevenly distributed geographically. Areas vary greatly in use intensity (Stankey and others 1976; Hendee and others 1978; Lucas 1980; Roggenbuck and Lucas in press). The average annual use per acre was 0.31 12-hour visitor days for National Forest wilderness in 1984 (comparable figures are not available for National Park, Wildlife Refuge, or Bureau of Land Management wilderness). But several wildernesses in North Carolina average over 6 visitor days per acre, 20 times the national average, while several in the West and Alaska average less than 0.1 visitor day per acre, or 30 times less than the national average. Within individual wildernesses, use of access points is very uneven. Typically, less than one-fourth of the accesses in an area account for over three-fourths of its total use. Use of trails, water routes, and wilderness campsites is similarly concentrated. Most trails were built more than 50 years ago for administrative use rather than recreation; they are commonly poorly located and this often concentrates use, detracts from visitor experiences, and contributes to trail deterioration (Krumpe and Lucas this volume).

Visitor characteristics, in contrast to use patterns, appear similar among wildernesses (Hendee and others 1978; Lucas 1980; Roggenbuck and Lucas in press). The most distinguishing characteristic of wilderness visitors is very high educational levels. In most areas, about 40 percent of the visitors have graduated from college, and most of these have studied beyond graduation. This is about four times greater than for the total population 25 years old or older in the United States.

Wilderness visitors tend to be young adults, although in most places only the under-16 and over-54 age groups make up a smaller percentage of wilderness visitors than of Americans in general. About 70 percent of wilderness visitors are males, but more recent studies report more women visitors than in earlier years.

Reflecting high educational levels, and predominance of males, persons in the professional and technical occupations, together with students, make up over half of the visitors to most wildernesses, far above proportions of the total population. Visitors' incomes vary among areas, from only a little above the national average to well above it. Most visitors live fairly close to the wilderness they visit. Visitor groups most often consist of family members or family and friends.

#### Attitude Research

Visitor attitudes about wilderness, wilderness conditions and use, and management actions are not a simple prescription for wilderness management, but they are important for consideration in choosing management actions, in evaluating management efforts, and in planning public educational programs.

Studies of the reasons why people visit wilderness often have not been comparable, but, in general, appreciation of scenic beauty, natural conditions, solitude, temporary escape from civilization, and activity-related reasons (to fish, hike, hunt, etc.) lead the list (Stankey and Schreyer in press). Autonomy and freedom are also often cited. Groups of visitors with differing clusters of psychological motivations have been identified in a number of wildernesses. Some types of visitors seem more dependent on wilderness conditions than others, and a potential for conflict exists (Haas 1979; Manfredo 1979; Stankey and Schreyer in press).

Attitudes about solitude and the desirability of the number of other visitors observed have been studied more than any other attitudes, particularly in relation to carrying capacity (Stankey and Manning this volume). Increasing use leads to increasing levels of encounters among visitors (Shechter and Lucas 1978; Stankey and Schreyer in press), which tends to cause increased perceptions of crowding, particularly when encounters exceed the number expected (Shelby and others 1983).

The relationship of encounters to visitor satisfaction is complex (Manning 1985), depending on the visitors' characteristics, especially the importance they attach to solitude compared to other reasons for visiting wilderness, and on the type of visitors encountered and how they behave. Large groups are particularly disruptive of others' solitude (Stankey 1973). Where encounters occur also affects how visitors respond to them; in particular, encounters at campsites are usually disliked more than on trails. The typical wilderness

camper expresses a preference for no other camping groups within sight or sound (Stankey 1973; Lucas 1980, 1985a; Manning 1985). Many studies report preferences for total contacts of three per day or less (Manning 1985). The effect of the level of encounters per day on visitor satisfaction seems weaker for river floaters than for hikers and horseback travelers (Graefe and others 1984; Stankey and McCool 1984; Lucas 1985a).

Many studies have shown that some types of impacts caused by other users have negative effects on visitor satisfaction (Stankey and Schreyer in press). Littering universally evokes a strongly negative reaction. Research dealing with the relation of visitor impacts on soil and vegetation to visitor satisfaction are less clear (Lucas 1979). Visitor perception of impacts other than littering is generally limited, and visitor satisfaction usually is little affected. Managers tend to consider resource impacts to be more serious than do visitors.

Research on wilderness visitors' attitudes about facilities and improvements shows that support is limited for everything except trails, bridges, and signs (Hendee and others 1978; Stankey and Schreyer in press). Most campsite facilities, such as tables, fireplaces, and toilets, are opposed by a plurality of visitors, with considerable variation from place to place related to what facilities are already there. Simple fire rings built by visitors are usually accepted. There seems to be a trend toward more purist attitudes favoring less development, but complaints about poor trails are increasing in some areas (Lucas 1985a).

Studies of attitudes about management of visitors show willingness to accept restrictions on use if necessary to protect wilderness, but a preference for lighter-handed, less rigid and authoritarian approaches (Lucas 1985b; Stankey and Schreyer in press). Use of information and education is preferred over regulation. Party size limits have more visitor support than length-of-stay restrictions and seem to produce more benefits for both visitor experiences and ecosystems. Where numbers of visitors must be limited, first-come, first-served and advance reservations have usually been favored more by visitors than lotteries, pricing, or tests of knowledge and skill (Stankey and Schreyer in press). Visitor acceptance of use-rationing programs, even by people unable to obtain a permit to visit an area, is high (Fazio and Gilbert 1974; Stankey 1979).

### Use Trend Research

Trends in wilderness recreational use have been little studied. Lack of reliable standardized data contributes to this gap. Only the Forest Service has reported estimated recreational use for individual wildernesses, and the units of measure from 1965 on are not comparable to earlier figures (Washburne and Cole 1983). The accuracy of estimated use is also questionable. But, overall, National Forest wilderness use grew rapidly after World War II, and has been slowing down since then (Petersen 1981; Forest Service annual wilderness recreational use reports). During the first post-war decade, wilderness use grew at an annual average rate of about 13 percent, in the next decade at about 10 percent. In the first decade after passage of the Wilderness Act in 1964, use grew about 6 percent per year, and, in the most recent decade, at an average of 4 percent per year. Over the 40 years, total use has grown nearly twentyfold, but, if recreational use of new wildernesses is excluded, the 88 "core wildernesses" in existence in 1964 show no growth in the last decade. (Figures for

previous decades are unchanged because most new wildernesses have only been added to the system in the last decade.) Use of the core wildernesses peaked in 1979 and declined about 17 percent to 1985. During the last 5 years, growth in estimated use has been due entirely to additions of new wildernesses to the system.

Hiking and backcountry use in general appear to be leveling off (Spencer and others 1980). Many major National Parks report that backcountry camping peaked in the mid-1970's to early 1980's and has declined more recently, often substantially. For example, Rocky Mountain National Park reported a 45-percent decline from 1977 to 1984, and Grand Canyon a 41-percent decline from 1976 to 1984. The slowdown is too recent to be projected, and poor-quality data suggest a need for caution, but something approaching stable use seems likely. Possible reasons for leveling off or declining use are but changing population structure, economic shifts, changing conditions in wilderness, more use regulation, and changing tastes are probably all involved. More stable use gives wilderness managers an opportunity to catch up with problems and solve at least some of them, while perhaps reducing the need for stringent visitor regulation. Use is still heavy in many wildernesses and still increasing in some, however, and localized problem areas remain common.

### Benefits

Most of the limited research on benefits has been psychological and social-psychological (Haas 1979; Manfredo 1979; Kaplan 1984; Driver and others in press), with less economic research (Barrick in press; Walsh and others in press). Most social-psychological studies have shown personal benefits although both methods and results have varied, rendering comparison almost impossible. Benefits vary widely among individuals, depending on each person's perceptual frame of reference (Stankey and Schreyer in press). Researchers have reported that wilderness experiences can help visitors attain higher states of awareness, leading to increased self-actualization (Scott 1974; Young and Crandall 1984), which for some carries religious connotations (Graber 1976). Economic benefits research has found greater values of wilderness preservation, based on total willingness-to-pay, for the general public than for wilderness visitors (Walsh and others in press).

Economic research related to wilderness allocation has shown that, in some cases, leaving an area undeveloped may have greater value than developing it (Fisher and others 1972). Opportunity costs of classifying land as wilderness, especially in foregone timber values, have been estimated as very low (even negative for modest amounts of wilderness) in one area, but high in another that has, much greater timber producing capability (Campbell and Countryman 1981).

### Ecological Impact Research

Much of the research on the ecological impacts of recreation has been done in wilderness, probably because impacts are more undesirable in wilderness due to the importance of perpetuating natural conditions (Cole this volume). Amount of use is not the only factor influencing impacts, and often is less important than type of use, behavior of visitors, and site conditions (Cole in press). Trail impacts relate mainly to location, design, and maintenance of trails, with use a minor factor. Camping rapidly causes substantial impacts on soils

and vegetation on new, previously unused sites, and slowly causes moderate impacts on old, established campsites. Number and distribution of impacted areas needs to be considered, as well as severity of impacts (Cole 1982). Introduction of exotic plants and animals (particularly nonnative fish) associated with recreational use also threatens natural conditions (Hendee and others 1978; Cole 1981; Crowder 1983). Impacts on water (Herrman in press), wildlife (Ream 1980; Boyle and Samson 1985), and air (Schreiber and Newman in press) are less studied (Cole in press). Outside threats, particularly air pollution, including acid deposition and visibility impairment, but also water pollution in some places, may be serious but have been unstudied until very recently (Schreiber and Newman in press; Williams and Jacob this volume).

### Recreation Management Research

One of the more studied wilderness management problems is recreational carrying capacity (Stankey and Manning this volume). Early expectations that clear maximum use levels could be identified were dashed as research showed that acceptable wilderness social and ecological conditions were affected by many factors in addition to amount of use (Graefe and others 1984; Shelby and Heberlein 1984; Stankey and McCool 1984; Manning 1985; Stankey and Manning this volume). Research has led to a reformulation of the problem as protecting natural conditions and opportunities for wilderness experiences, using a variety of management actions rather than focusing on controlling amount of use. Based on this, the Limits of Acceptable Change (LAC) system has been developed recently to give managers a practical tool for managing wilderness capacity (Stankey and others 1985). A similar process, Visitor Impact Management (VIM) is being developed with the National Park Service (Graefe and others 1985). Application and testing have been limited so far (Stankey and others 1984).

Research has identified the criteria for evaluating use rationing alternatives, in areas where use limitation is necessary, and evaluated rationing systems. A combination of rationing systems is usually best to meet varying needs of different types of visitors (Stankey and Baden 1977; Schomaker and Leatherberry 1983).

Research has developed the distinction between direct visitor management, 'stressing control of users, and indirect management, stressing influencing visitors' decisions, mainly through education, information, and site design. The advantages of indirect, non-regulatory approaches have been identified (Gilbert and others 1972; Hendee and others 1978; Lucas 1983).

One of the most 'promising indirect management techniques, providing information to visitors to change their decisions about where to go, has been the subject of a few studies. It appears that when used well, substantial changes in visitor distribution can result (Lime and Lucas 1977; Krumpe and Brown 1982; Roggenbuck and Berrier 1982; Roggenbuck and Ham this volume). Other efforts have had little effect. Comparing these studies has led to guidelines for success (Lucas 1981). Research on campsite impacts has been translated into suggestions to visitors for choosing places to camp (Cole and Benedict 1983).

Several simulation models of recreational use to aid visitor management planning have been developed and applied (deBettencourt and others 1978; Shechter and Lucas 1978; Rowe11 in press). Use measurement methods for wilderness have never progressed to the extent that they have for campgrounds and other similar

developed recreation sites, but some progress has been made in both equipment and estimation procedures (Roggenbuck and Lucas in press).

Monitoring is essential for effective management and is legally required in National Forest wilderness. Methods have been developed for monitoring trail and campsite physical-biological conditions, but not for solitude and other aspects of visitor experiences (Cole 1983a, 1983b; Lucas and Stankey 1985).

### Wilderness Fire Research

Freely operating natural processes are an essential goal for wilderness management. Research on the natural role of fire in wilderness ecosystems has shown clearly that fire has been an important ecological force in most areas and that suppression of fire has altered natural processes profoundly. Ways of reintroducing natural fire are being developed and tested (Lotan and others 1985; Kilgore in press). Many types of wildlife benefit from natural fires, and this, in turn, can improve visitor experiences, as can exposure to more varied, more natural landscapes.

### CASE STUDY

One of the most innovative attempts at wilderness management is now underway in the Bob Marshall Wilderness complex. Here, on three large, adjacent wildernesses--Bob Marshall, Great Bear, and Scapegoat--located in four National Forests in Montana, state-of-the-art concepts are being applied (McCool in press). This is a cooperative effort involving wilderness managers, university and agency scientists, and the public. The Limits of Acceptable Change (LAC) system has been implemented (Stankey and others 1984); campsites have been inventoried using the most current techniques; a soil survey has been conducted; grazing's effects on range conditions were determined; visitor characteristics, attitudes, and use patterns were surveyed as a followup to a 1970 study to identify trends; river recreationists and site conditions were studied (McLaughlin and others 1982); a computerized geographic information system has been set up; a new approach to public involvement, based on the "transactive planning" model (Stokes this volume), has been used; and a special education program is being developed. All of the concepts and techniques have been integrated into a pioneering wilderness management effort that should aid wilderness managers everywhere.

### ISSUES AND PROBLEMS

A number of issues and problems emerge from wilderness research to date:

1. What types of recreational opportunities should wilderness provide? Should the range of opportunities in wilderness be relatively wide and inclusive (within the terms of the Wilderness Act), or narrow, with wilderness more distinctive?
2. Is there a need to manage some public lands for nonwilderness types of primitive recreation?

3. How should wilderness carrying capacity be managed?
4. How can visitor regulations be minimized while protecting wilderness values?
5. How can public education and information be made more effective tools for managing recreational use?
6. Is wilderness recreational use really leveling off or declining? If so, why? What are the implications of trends in use?
7. How serious are outside pollution threats, and how can they be dealt with?
8. How can monitoring become effective at acceptable cost?
9. How can impacted areas be rehabilitated effectively and economically?

## RECOMMENDATIONS

Our recommendations for solving the problems encountered above are drawn from research. The recommendations are generally consistent with Wilderness Management--A Five-Year Action Plan developed as followup to the National Wilderness Management Workshop held at the University of Idaho in 1983 (Frome 1985).

1. Reaffirm the goal of keeping wilderness distinctive. Preservation of natural processes and conditions should be the overriding goal, along with provision of opportunities for a unique visitor experience dependent on natural conditions.
2. Complement wilderness with provision of a variety of high-quality semi-primitive recreation opportunities on undeveloped public lands outside wilderness. This will meet diverse public recreation needs and desires, and reduce pressures on wilderness for types of recreational use that would diminish its distinctive, special character.
3. Further apply and test the Limits of Acceptable Change system as the most promising way of managing wilderness carrying capacity.
4. Emphasize the monitoring of wilderness use and conditions to provide a foundation for management.
5. Stress educational/informational approaches as a means of visitor management and as a means for minimizing regulations that tightly control visitor movement and behavior.
6. Increase trail maintenance to control environmental damage and meet visitor needs.
7. Relocate and redesign trail systems to reduce damage and provide better experiences for visitors.
8. Measure wilderness recreational use in comparable ways for all wildernesses administered by the National Park Service, Forest Service, Fish and Wildlife

Service, and Bureau of Land Management to enable comparisons and to identify trends.

## KNOWLEDGE GAPS AND DIRECTIONS FOR RESEARCH

The processes involved in environmental impacts caused by recreational use are only partially understood. Only a very small proportion of areas in the wilderness system have ever been studied, and some major types of ecosystems are unstudied. This hampers minimum impact education programs, efforts to mitigate impacts, and attempts to restore impacted sites (Cole in press, Cole this volume).

The visitor communication process is not well understood. Managers' efforts are based on intuition because of the lack of research, and, as a result, use of education/information as an alternative to regulation is less effective than it could be.

Monitoring methods need to be developed for visitor experiences (crowding and solitude, especially) to complement those for environmental conditions (Lucas and Stankey 1985).

Monitoring methods for environmental conditions need continued improvement. Air quality in wilderness and its effects are poorly understood. Current research needs to continue and be strengthened.

Technology for accurately and cost-effectively measuring wilderness and other dispersed recreational use needs to be developed. Use measurement research started 15 years ago, but it was never completed and is now inactive.

Trends in wilderness recreational use and users need to be determined and causal factors identified and analyzed.

Methods for determining the degree and character of unnatural ecological conditions due to past fire suppression, and ways of reintroducing fire without producing unnatural results need research and development.

Wilderness wildlife and how use and management actions affect it are inadequately understood and need more research emphasis.

## CONCLUSION

Much good research has been done. The National Wilderness Research Conference proceedings (Lucas in press a, in press b) report a considerable amount of current and past research. But the knowledge base for every important topic is inadequate to meet the wilderness management challenge.

Current research is far too limited to close the gaps. There is less wilderness research now than a decade ago (Lucas in press c).

Meanwhile, the National Wilderness Preservation System has grown greatly in numbers of areas and acres, in geographical distribution, and in types of ecosystems represented. This has resulted in types of use and management problems spanning a wider range, also. As the wilderness designation process nears

resolution, management to protect the lands designated as wilderness will become a critical need.

## KEYWORDS

Wilderness, research, capacity, recreational use, attitudes, visitor impacts, management, education, regulation, fire, trends, projections

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