Effectiveness of limiting use in wilderness areas

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The Effectiveness of Limiting Use in Wilderness Areas

By

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Appendix A Use-impact relationship graph
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A study was conducted to evaluate the effectiveness of the policy of limiting use in wilderness areas in the United States. Twelve wilderness managers were interviewed in an open-ended discussion question format. Responses were compared and contrasted to determine if any differences exist between internal (fixed itinerary) and external (trailhead quotas) methods of limiting use. The idea of effectiveness was operationalized by examining two issues, the relationship between use and social and ecological impacts, and visitor freedom. Findings suggest that fixed itinerary systems reduce ecological impacts through concentrating use and are more effective than trailhead quotas which primarily function, through probability, as a re-distribution mechanism. In terms of social impacts, trailhead quotas appear to be more effective at protecting a visitor's experience by minimizing management presence. It is the level of control over the camping and hiking experience that differentiates the two systems or approaches and poses the most significant implications for visitor freedom. Although all managers felt that both ecological and social impacts have been reduced since limits were implemented, few managers could provide data to substantiate their claim. It was clear through the responses that the success of limiting use rests in the integration of various techniques. Consequences and implications of limitation strategies and applications are discussed.
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CHAPTER ONE

Problem Statement

A hundred years ago, as the American frontier was vanishing, John Muir extolled the virtues of wilderness and ignited a preservation movement that called for participation and celebration of wild lands:

You know that I have not lagged behind in the work of exploring our grand wildernesses, and in calling everybody to come and enjoy the thousand blessings they have to offer.

(John Muir, In Nash 1973, p. 122)

Now people rush by the millions from their urban environments to recreate in the remaining untracked public lands. This change in attitude, from trepidation to appreciation, threatens the essence of wildness. Through encouraging the use and accessability of wilderness to achieve preservation, Muir did not expect that modern America would face the demand and deterioration caused by recreational use.

The specific requirements for maintaining character comprise philosophical, political and legal directives (Public Law 88-577; Organic Acts 1897; 1916). These present management with interminable dilemmas, and managers face difficult choices regarding what action to take and when to act. The many uses of wilderness confound the situation. Scout troops learning outdoor skills, church groups seeking solace for retreat, students observing ecological processes, fisherman following stream banks, climbers ascending mountain faces, and many individuals escaping their routines; all use the wilderness for their various needs. Wilderness management ultimately and inescapably implies managing visitors (Hendee et al. 1978).
In response, managers have adopted policies limiting recreational use of wilderness areas and controversy has plagued the practice since its inception in the early 1970s. This study will focus on two aspects of the controversy, the non-linearity of the use-impact relationship, and the irony in putting constraints on a person's freedom in wilderness.

Research on soils and vegetation show that damage can occur at low levels of use, and these changes do not always become more pronounced as use increases (Frissell, Duncan 1965; Dotzenko et al. 1967; LaPage 1962; Merriam et al. 1974; Young 1978; Cole 1982). The nonlinear relationship between amount of use and amount of impact, it is argued, invalidates the technique of limiting use:

Our understanding of the use-impact relationship now tells us that it is anything but direct, invariant and linear (Cole 1987). Impacts are largely influenced by visitor behavior and the bio-physical character of the resource. Thus, use limits may be relatively ineffective in resolving the problem they were established to control (McCool et al. 1987).

Research findings suggest that by focusing on an acceptable amount of use, managers obscure the types of use or situational factors that are causing impact. Amount of use alone may not be the most relevant factor to control. (Washburne 1982).

The authoritarian nature of these restrictions is also criticized. The "heavy-handed" technique of limiting use is viewed as violating the freedom and experience of the wilderness traveller (Lucas 1982; Wuerthner 1985). Increasing management presence diminishes the presumed character of wilderness; it dilutes the experience of risk, self-reliance, freedom and independence that is associated with wilderness (Wuerthner 1985; McAvoy and Dustin 1981; Mackay 1988). The effectiveness of limiting use to achieve a reduction in social and ecological impacts is, it seems, enigmatic.
**Objectives**

I will be addressing the controversies of limiting use through a review of the literature, and in a study of existing practices. Two of the primary methods of allocating use, trailhead quotas and fixed campsite itineraries, will be compared by drawing on the perceptions of twelve wilderness area managers. I will attempt to determine:

1) The efficacy of, and differences between, two management systems -- quotas and fixed itineraries -- in reducing social and ecological impacts.

2) The administrative and political costs of these systems.

3) Perceived visitor acceptance of the restrictions.

4) Other management practices that are used in addition to limiting use, which may be found to be effective in reducing impacts.

**Summary**

In this paper I will evaluate the policy of limiting use. By looking at actual practices, I will attempt to show that allocation systems have affected the reduction of social and ecological impacts, with salient differences between quotas and fixed itinerary regimes.

I propose that for use restrictions to be successful, there is no need for a linear relationship between use and impact. Wilderness managers need a framework that approaches use and impact as interconnected in complex patterns of nonlinear and random processes. I will attempt to demonstrate that the process of limiting use offers a viable strategy for long term reduction of impacts; but the application of use limitation techniques should be based on an understanding of the problem and consequences of the action to the ecology and the social dimension.
CHAPTER TWO

LITERATURE REVIEW

The Management Dilemma

In 1964, the Wilderness Act (Public Law 88-577) established the National Wilderness Preservation System which set in motion an allocation/classification process, but provided only a vague framework for management. It is the job of wilderness managers to translate this law into practice, by formulating and implementing appropriate policies. Constrained by a diverse constituency, low agency priority for wilderness, and periods of severe retrenchment, managers have a difficult task.

Wilderness acreage now nears 91 million acres. A recent study conducted by the U.S. General Accounting Office (GAO) indicates that the wilderness resource under the jurisdiction of the Forest Service is deteriorating (GAO 1989). Extensive damage was found to be occurring in several Forest Service wilderness areas, particularly on trails and at popular camping areas. Managers were considered tentative in their management of wilderness, with a long list of inadequacies (Vento 1989). Although the study focused on the Forest Service, these same could be said for the other agencies that manage wilderness -- National Park Service, Fish and Wildlife Service and Bureau of Land Management.

A partial explanation for the inadequacies revealed by the GAO report lie in the mandates of the Wilderness Act. This Act orders the protection of land for two purposes which often conflict:
These shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for their protection of these areas, the preservation of their wilderness character... (section 2a)

The law defines wilderness, recognizing its primeval character and natural conditions (section 2c). This distinct quality of wilderness has been articulated in spiritually charged language by John Muir, Henry David Thoreau, and Aldo Leopold, amongst others. Both the political and philosophical definitions play a integral role in the management of these lands and lead to an assumption that wilderness use should be a low density type of recreation (Lucas 1978).

The fact that wilderness areas, once designated, remain under their agency administration complicates the preservation process. Agencies responsible for the protection of a wilderness resource -- the National Park Service, Fish and Wildlife Service, Forest Service, and Bureau of Land Management -- are saddled with layers of legal decrees in addition to the Wilderness Act. For example, the management plan for Mt. Rainier National Park lists fifteen federal legislated Acts, two executive orders, and ten Department of Interior or N.P.S. policies or plans. Each governing agency is guided by distinctly different ideologies and political functions. This situation hinders efforts to achieve cohesive wilderness management goals.

The Forest Service and National Park Service administer the most wilderness lands. These agencies were established by the Organic Acts of 1897 and 1916, which defined general objectives in regards to the resource. The Park Service values natural processes, historic objects and scenery (Hartzog 1988), while the Forest Service’s multiple use philosophy is oriented towards timber, oil and gas, and recreation. Wilderness is managed within these objectives and frameworks. Both agencies, however,
have acknowledged that use levels must be established to manage wilderness quality (the National Forest Management Act, 1976 and the Management Policies of the National Park Service). Regardless of orientation of the agency, it is widely agreed that management of wilderness comes down to management of visitor use (Lucas 1973; Stankey et al. 1976; Hendee et al. 1978).

The need to manage visitors gave rise to the carrying capacity concept. This concept, borrowed from range management, evolved from a recognition that increasing recreational use was affecting the resource (Sumner 1940). When reformulated to apply to wilderness, the notion attempts to determine a number of users that can be accommodated by a given area without compromising quality of the natural environment and/or the visitor experience (Shelby and Heberlein 1986).

Early recreational carrying capacity models identified and focused on two components: the social and ecological. The social component refers to impacts which impair or alter human experiences (Shelby and Heberlein 1986). The ecological component is concerned with impacts on the ecosystem (Shelby and Heberlein 1986). Studies have predominantly focused on one aspect or the other, occasionally integrating these features. Defining appropriate use levels requires management to determine acceptable standards. Capacities that are established rely upon a numerical representation of ecological and social features (van Wagtendonk 1981).

The Limits of Acceptable Change Planning approach (LAC), represents an extension and reformulation of the carrying capacity concept. This approach attempts to determine acceptable amount of change or impact rather than amount of use (Stankey et al. 1984). The end product is the set of management practices needed to limit impacts to an acceptable level.
A prominent contribution of LAC is that it places the issue of capacity in a prescriptive context (Stankey et al. 1984). The LAC process requires defining and describing management zones, or "opportunity classes," where different resource, social, and managerial conditions are maintained. Indicators of resource and social conditions are then selected to represent conditions for each opportunity class. Standards are set for the resource and social indicators, and management practices are then identified for each opportunity class (Stankey et al. 1984; Stankey et al. 1985).

The zoning approach surfaces in many management plans (Haas et al. 1985; Clark and Stankey 1979; Stankey et al. 1985). The concept of opportunity classes, or zones, articulates the role of management, and creates managerial conditions. Zones recognize the diverse constituency of visitors in wilderness, and the need to manage for these diverse and often conflicting uses. The wilderness setting then, includes ecological, social and managerial conditions that give it value (Clark and Stankey 1979).

Achieving a balance between the "draw-a-line-and-leave-it-alone" approach and increasing agency control over use and user is the management dilemma. To provide a range of experiences in one wilderness area is a perplexing goal for managers. The potential of diminished wilderness character due to the effects of humans is a genuine concern.

It is important that management distinguish the plan from the regulation. One problem with the traditional carrying capacity approach was that the plan directed managers towards regulating use, when not all cases required limiting use. Because the plan isolated and focused on use, use became the logical regulation. Ideally, the plan should establish standards, and actions should evolve to address and maintain those
standards. Monitoring of impacts, using indicators that can detect change, determines if standards of acceptability have been exceeded.

Once management determines that actions are necessary to protect quality, an appropriate strategy is established. Fleischner (1988) identifies five options managers have to accomplish the task of maintaining wilderness standards: 1) limiting access; 2) preventing physical damage through technical means; 3) restoring damaged areas; 4) long range planning and 5) public education.

Decision and policy making requires a value judgement based on technical information about social and ecological impacts. Management is not value-free. Limiting use is one of many strategies that management can employ.

**Strategies for limiting use**

Many strategies fall into a broad category of use limitations. They include limitations on party size, wood fire restrictions, area or campsite closures, length of stay limits, minimum camping distance from water or trail, mandatory permits, and limitations on access, the subject of this paper.

Use limitations were first exercised in some heavily used wilderness areas prior to the 1970s. Sequoia-Kings Canyon National Parks (SEKI) pioneered controls in 1958 with a camping closure at Bullfrog Lake, a traditional first night out destination (Taylor 1972). In 1966, the U.S. Forest Service required mandatory permits in the Boundary Waters Canoe Area in Minnesota. In 1969 the San Gorgonio Wilderness, located adjacent to the Los Angeles metropolis, began an advanced reservation system for required permits (Amo 1971).
In 1972, the Department of Interior directed three NPS parks -- Rocky Mountain, Great Smoky Mountains and Sequoia-Kings Canyon -- to initiate a trial program of limiting use. By 1973, 43 Wilderness and Primitive Areas required visitors to obtain a permit before entering (Lime, Buchman 1974). By 1983, 40 wilderness or proposed wilderness units were applying some type of use rationing (Washburn and Cole 1983).

Permit systems are imposed in a variety of ways and serve many purposes. Two notable features of a wilderness permit system are 1) use data information that is recorded on a permit; and 2) the opportunity a permit provides for education (Lime, Buchman 1974). The variety of information recorded on a permit can be tabulated to provide relatively accurate use summaries for amount of use, temporal and spatial characteristics, type of use, trends in use and demographics (van Wagtendonk 1981). However, the modification of travel routes and lengths of stay by visitors, reduces the validity of such information (van Wagtendonk and Benedict 1980).

An alternative way to gather use data is voluntary permits or registration. Lucas (1975), however, found that only 25% of visitors to a portion of the Selway-Bitterroot wilderness registered at voluntary stations. Though it reduces the infringement upon a visitors freedom, gross overall estimates of visitor use based on registration and voluntary permits are, therefore, of limited value (Lime and Buchman 1974).

Wilderness permits, if limited, must be rationed, i.e. there must be a method of allocating a permit. Stankey and Baden (1977) discuss five possible methods of rationing use. They are by advanced reservation, lottery, queuing, price and by merit. At present only river allocation methods use a lottery. Land based allocation systems use either advanced reservation, queuing (first-come, first-serve), or, more commonly, a
combination of both. With a combination, a certain number of permits are issued by advanced reservation and the remainder is available first-come, first-serve.

Advanced reservation systems require considerable administrative apparatus. Requests are processed and recorded by mail or telephone. Many areas have experienced a substantial no-show rate which disadvantages those trying to obtain permits on a first-come first serve basis. Some areas charge a fee for a reservation, in hopes of reducing this no-show rate.

Rationed permits are issued for zones, trailheads, specific campsites, or the entire area. Because managers can apply these mechanisms in ways that offset constraints upon the visitor, it is inaccurate to generalize on their restrictiveness. They do however, fall into two basic categories, internal and external constraints, those that place restrictions upon the visitor before entering, and those that constrain the visitor once they are inside the wilderness. Examples of limitation techniques include the following:

**Trailhead quota** - An external control where the number of people allowed to enter at each trailhead per day is limited. A quota is determined for each trailhead. Once entry is attained, users can camp anywhere in the wilderness area and are only restrained by additional rules and regulations.

**Fixed campsite itinerary** - An internal control whereby users are required to camp at specific campsites on specific days. Some areas have designated sites that accommodate single parties, while other systems designate camp areas that accommodate multiple parties.

**Fixed zone itinerary** - An internal control where visitors are required to camp in a given zone for each night. The itinerary is planned and determined at the time the
permit is issued. Though not as specific as designating campsites the visitor must camp at, the system requires the visitor to follow a specific itinerary.

**Zone quota** - An external control in the form of a quota for a designated area. Specific campsite selection criteria are required and communicated upon receiving permit. Similar to trailhead quotas, this zone can be large and thus less restrictive, or small and thus more restrictive than trailhead quotas.

**Entire area quota** - An external quota on the entire wilderness area, not regulated by access point unless only one access point exists.

These four categories can be and often are applied in combination. For instance, some areas will be predominantly a fixed campsite itinerary system with one area designated as a zone quota or a trailhead quota. Or, areas that use predominately trailhead quotas may have certain areas that have designated campsites where visitors are asked or are required to camp in a designated area or specific sites if they overnight in that area. In this paper I classify an area by its principle method. I will be comparing internal methods of control - fixed campsite itinerary, to external methods of control - trailhead or zone quotas.

The choice of strategies requires accurate perception of the problem and an understanding of the consequences of the actions. It also requires an understanding of the process by which impacts become unacceptable. Since the basis of management judgement comes primarily through technical information acquired through observation and research efforts which focus on social and ecological impacts, these will be discussed as a background to the issues involved in the policies of limiting use.
Social impacts associated with use

The social aspect in wilderness involves the degree to which the human component affects a user’s experience. The perceptual nature of wilderness and experience (Godin and Leonard 1977; Stankey and Lucas 1984) entails a complexity in the role of the social, and its management.

The notion that wilderness recreation requires low human density led to an assumption that an increase in use results in a decrease in satisfaction (Stankey 1973). Results from studies of observed and recorded behavior, however, demonstrate a poor relationship between amount of use and user satisfaction (Shelby 1980; Bultena et al. 1981; Absher and Lee 1981; West 1982). These studies suggest that situational variables including setting attributes, number of encounters, size of group, method of travel and behavior of the groups encountered, had a stronger correlation to satisfaction than merely amount of use.

In a study of visitor acceptability of campsite impacts in the Mt. Jefferson wilderness, Shelby and Harris (1986) concluded that norms or standards appeared different for the different experiences offered at different locations. Lime (1977) suggests that perceptions of crowding change as the visitor penetrates the backcountry. As they penetrate the interior, tolerance drops as expectations of solitude rise.

Expectations for differing experiences, and attitudes toward encounter levels were found to influence visitor perception of crowding by Schreyer and Roggenbuck (1978). Yet correlations between visitor’s attitude and their behavior appear weak at best (Lee 1977). Studies have branched into the field of choice behavior, utilizing socio-psychological theories and methodologies to improve understanding of the attitude-behavior relation. Results remain inconclusive (McCool et al. 1985).
Two mechanisms of coping behavior, displacement and rationalization, further obscure definitive understanding of satisfaction. It has been suggested that displacement occurs when use densities increase and those less tolerant of higher densities alter their patterns to avoid crowding (Absher and Lee 1978; Manning 1979). Rationalization occurs when an increase in use alters the character of the experience, and as this happens people change their normative definition of appropriate contact levels so expectations don’t destroy their experience (Heberlein and Shelby (1977). Both these forms of coping behavior acknowledge that as use levels increase, the character of the experience changes, but that this does not necessarily lower satisfaction.

Crowding then, as it relates to satisfaction, is a normative concept. Increasing use densities are not negatively interpreted as crowding until it is perceived to interfere with or disrupt one’s objectives or values (Manning 1987). Characteristics of the visitors and the groups encountered, along with situational factors or setting attributes complicate the understanding of satisfaction.

Some argue that management presence diminishes a user’s experience (Wuerthner 1985; McAvoy and Dustin 1981; Mackay 1988). This has been countered by studies providing evidence that limiting use protects the experience, and users are supportive for that reason. In Denali National Park, both the concept and practice of rationing and allocating use were supported by those to whom solitude was important (Bultena et al. 1981). Similarly, Absher and Lee (1978) found no negative responses to the imposed limits on use in Yosemite National Park. These findings suggest that people are willing to sacrifice freedom of choice in order to obtain guaranteed experiences (Bultena et al. 1981).
In contrast, Stewart (1989) found low rates of compliance with fixed itineraries in the Grand Canyon and Saguaro National Parks. Findings showed that although there was a high rate of compatible attitudes toward the concept of fixed itineraries, those with more hiking experience in the area, and those dissatisfied with sanitary facilities were found to be more likely not to comply (Stewart 1989).

**Ecological impacts related to use**

Ecological impacts caused by human activity result in changes to environmental processes. This section will review the scientific research pertaining to the deterioration process, with particular attention given to the relationship between amount of use and amount of change. Campsites will be the primary focus, since policies of limiting use most directly affect this aspect of wilderness. Trails and water quality will also be reviewed.

**Campsites**

The affect of trampling on soil and vegetation at campsites has been well documented. Results show that the rate of change reaches a peak with light to moderate use, and beyond this point decreases significantly. This curvilinear relationship is graphed in Figure 1.

The inter-relatedness of the soil cycle and vegetation is significant to the understanding of this deterioration process. (Manning 1979). Soil compaction decreases soil macroporosity, air and water permeability and consequently soil moisture (Manning 1979; Liddle 1975; Dotzenko 1967). This results in increased runoff and erosion potential, and creates hostile bedding conditions for vegetation (Hadley 1988).
Merriam and Smith (1974) and LaPage (1967) examined the rate of deterioration on new campsites, and determined that an equilibrium is reached beyond which loss of vegetation and soil compaction does not occur. Other findings, using a study design that compares campsites to control sites, substantiate that deterioration is great even on lightly used sites (Frissell and Duncan 1965; Dotzenko et al. 1967; Young 1978; Fichtler 1980; Cole 1982).

The curvilinear relationship between use and impacts to soil and vegetation has important implications for management policies related to visitor use. Since damage can occur at light levels of use, dispersing use would merely distribute impacts and increase the aggregate extent of damage (Cole 1982). In areas of moderate to heavy use, concentrating use on existing sites will prevent the proliferation of impacts and reduce the aggregate area of impact to soils and vegetation (Cole 1982). This has been done with fixed itinerary and designated campsite management regimes, or indirectly, through communicating to visitors to camp on existing sites.

The observation of resistance and susceptibility of types of vegetation and soil to trampling has furthered the understanding of the deterioration process. It has been well documented that graminoids- grasses, sedges and rushes - are more resistant than other (dicotyledenous) species (Willard and Marr 1970; LaPage 1967; Cole 1978). Dale and Weaver (1974) presented two categories of plants, increasers and decreasers, according to their frequency and coverage near trails. Coombs (1976) applied these plant categories to campsite studies, and suggested their use as a management tool and indicator of change. Similarly, Willard and Marr (1970) demonstrated a differential response in ecosystems to trampling; Fichtler (1980) demonstrated it in habitat types, and Cole (1986) in vegetation types.
The curvilinear relationship between use and impact has been illuminated by more recent studies that test several impact variables against frequency of use (Fichtler 1980; Cole 1982), and through studies of change over time (Cole and Marion 1987). Variables that do indicate a correlation between change and amount of use include loss of organic horizons, exposure of mineral soil, severe root exposure, and site enlargement (Coombs 1976; Young 1978; Cole 1982; Fichtler 1980; Cole and Marion 1987). The degree of curvilinearity indicates use thresholds differ between variables. This is graphed in Appendix A. This suggests that with increased use, some impact variables continue to deteriorate.

The notion of significant impacts, those impacts that affect functionality, utility or desirability, was introduced by Cole (1982). Although impacts are inevitable with any level of use, certain impacts may keep sites from being used by the visitors. For management, what becomes more important than an overall rating of amount of impact, is which impacts cause a campsite to lose its desirability.

The impact variables that appear to be more sensitive to use related changes may help our understanding of what factors negatively affect the functionality of a site. For example, Marion (Cole and Marion 1987) found that the size of a campsite shows very nearly a linear relationship between amount of use and impact (Appendix A). Typically, the campfire is a central feature of a campsite, and the effects of trampling are usually concentrated at this core (Stohlgren 1987). Stohlgren (1987) applied a study design that stratifies a site, measuring impact parameters separately at the core, intermediate, and periphery areas. The variability that occurs within these strata, may provide managers with a more realistic evaluation of change to a site. If light levels of
recurring use maintain a barren core area, change occurring at the periphery of a site may be a more significant impact to monitor or control.

The severity of trampling is a function of the type of visitor use. (Stohlgren 1987). The occurrence of impacts can be viewed as a random process. A horse party of ten, confining and grazing stock at a site, can have different impacts than ten smaller parties of backpackers. A party of two, with malicious behavior, can do as much to destroy a site in one evening as one or even ten seasons of use at a site. A party of twenty will require more tent sites for camping than a party of two, expanding the area of the camp. The randomness of the occurrence of impacts is an uncontrollable factor.

In addition to the effects of trampling on campsites, wood fires can produce profound changes in the ecology of an area. The removal of dead and downed wood for burning interrupts the cycle of decomposition, in which nutrients are recycled through the soil and mineral cycles (Schreiner 1978). Standing dead trees are occasionally felled as the supply of downed wood is depleted, a function of amount of use over time. Standing snags provide habitat for cavity nesting birds, and their removal can affect bird populations and scenic attributes.

The fire itself causes serious changes in soil properties. Due to the high temperatures at the soil surface, loss of nitrogen, organic matter, changes in pH and concentration of minerals result (Shreiner 1978). Ash and charcoal concentrations may cause changes (Cole and Dalle-Molle 1982), which repeated use exacerbates.

The proliferation of fire rings caused by dispersed camping can lead to a larger area of impact (Cole and Dalle-Molle 1982). Systems of limiting use that rely on the external constraint of a quota, are more prone to this damage. When campsite choice is left to the visitor, management ends up removing secondary sites and/or engineering
sites at a destination to concentrate use on more appropriate sites. Fire rings are often rebuilt by visitors in new locations, thereby affecting the ecology of a larger area. Finally, the aesthetic impacts of campfire use can diminish the desirability of the site (Lee 1975). A proliferation of fire rings, blackened rocks, scattered charcoal, fire scars, and large fire rings which are often used as trash receptacles can be objectionable to visitors, and may become a reason for visitors to use or make new sites because they don’t like impacted sites.

In summary, although deterioration of soils and vegetation results with light levels of use, other impacts continue to occur over time. These include site expansion, loss of organic horizons, exposure of mineral soil, severe root exposure (Coombs 1976; Young 1978; Cole and Fichtler 1983; Cole and Marion 1987). Some impact variables may be more significant to the functionality of a site (Cole 1982), and some variables are more sensitive to various site and visitor use factors. The deterioration caused by wood fires alone signals the need for appropriate policies in areas experiencing moderate to high levels of use.

Trails

Few studies have addressed the relationship between amount of use and impacts on trails, and conclusions are tentative. Helgath (1975), in a study of trails in the Selway-Bitterroot, found that trail location may be more important than use in causing deterioration. She concluded that landform, vegetation habitat type and trail grade have a greater effect on erosion and bog formation than elevation, aspect, parent materials, sideslope, soil horizon depths or amount of use. Kuss (1975) found that the greatest change in trail depth, cross-sectional area, and soil penetration resistance was found to
occur with low levels of use. In contrast to these two studies, Burdee and Renfro (1985) found that trail depth was related to visitor use, amongst other factors, while trail width was related only to soil type and vegetation type on the Appalachian trail in Great Smoky Mountains National Park.

Only a few studies have determined stock-related impacts. Sydoriak (1988) found that trails not used by stock were significantly less impacted than trails that received either light, moderate or heavy stock use in Yosemite National Park’s backcountry. This indicates that trail impacts can be a function of type of use, along with all the situational, and seasonal variables other studies suggest. Clearly, amount of use is only one of many variables responsible for these impacts.

Water

Very few studies have been conducted that relate water quality to recreational use. *Giardia lamblia*, a parasite causing the water related illness giardiasis, has been a growing concern of backcountry users. Both the National Park Service and Forest Service carefully and purposefully warn visitors of this and other water-borne illness and recommend that visitors treat their water, either through filters, boiling or iodine. This fear is generally associated with the increase in human use and/or cattle grazing. Suk et al. (1985) reported that cysts of *Giardia* were detected in 44.9% of high use area samples, compared to 17% in low use areas. Though not conclusive, it does suggest a correlation between use intensities and contamination.

In an earlier study in Sequoia-Kings Canyon National Park (SEKI), Erman (1979) found that lakes with the highest human impact had less nitrate and more aquatic plants on the bottom than did other lakes. Erman concluded by saying that the study indicated
recreational use may be causing changes in lake characteristics and that the changes in lake properties may be the result of long term use.

**Use Patterns**

Based on the results of ecological and social impact studies, it can be concluded that the degree of impact is related to complex situational variables, including environmental conditions and visitor use factors. Amount of use, by itself, may not exceed the standards of acceptability of a part or even all of the population.

The various forms of use pressures show similar patterns. Lucas (1980) studied use patterns in nine wilderness and other roadless areas, and found uneven, highly concentrated use everywhere. Over half of all visitors converge on one entry point (trailhead); and just three trailheads account for over 1/2 of all use everywhere except the Selway-Bitteroot. Similar use patterns were described by van Wagendonk (1981) in Yosemite's backcountry.

A pattern continues from trailhead use to destinations and impacts at destination points. Zuckert's (1980) study in the Sierra found that backcountry users tend to camp near to where the trail reaches the destination, and tend to choose the most obvious campsites, although the more experienced users discriminate shelter related features. Heberlein and Dunwiddie (1979) through actual field observation, found that site preferences were primarily based on the structural needs of the party such as size, activity and method of cooking (gas stove or wood fire). Again, experienced campers tended to select sites further from the nearest visible site and further from all occupied sites, substantiating Zuckert's findings. In Lucas' study in the Desolation Wilderness in
California, the most used 25% of the campsites accounted for over 60% of all use (Lucas 1980).

Other use patterns that play a role in management decision-making include the temporal distribution of use. Van Wagendonk (1981) describes a use pattern in Yosemite National Park, derived from mandatory wilderness permits. Predictably, use peaks on week-ends throughout the summer months, with accentuated peaks on the holiday week-ends. Early June experiences a sharp increase, plateauing mid-June through July, with August being the peak use month.

Identifiable patterns such as these play a crucial role in understanding the social and ecological impacts that occur in the wilderness. Patterns express the dynamics of use and impact, and can augment a quantified approach that measure static impact variables such as loss of vegetation etc.

Finally, whether a management decision is based on amount of use or amount of impact that is acceptable, some measurement and comparison must be drawn and a value decision made. Results of the many studies conducted on ecological and social impacts do not invalidate the management practice of limiting use, yet demonstrate how quota and fixed itinerary systems work very differently.
CHAPTER THREE

METHODS

Twelve wilderness managers were interviewed to determine their perception of the effectiveness of allocation methods. The twelve interviews were evenly split between those utilizing a quota scheme and those with fixed itineraries.

The sample of wilderness areas is representative, but not randomly selected. Washburne and Cole's (1983) survey of managers determined that forty-nine wilderness areas or proposed wildernesses had allocation systems or were planning to ration use. This included rivers, day use rationing, and each Forest Service district of a wilderness area. Through my own investigation, including inquiries at the onset of the study, I estimate that approximately 37 areas use some kind of overnight rationing method. Some areas listed in Washburne and Cole (1983) had dropped their rationing program, others had added one. Of these thirty seven areas, I chose a representative sample of similar types of wildernesses. They are all land based areas with moderate to large acreage. Samples reflect that most allocation systems are in California, and are National Parks.

The choice of manager to interview was complicated by the organizational structure of the agency unit. I tried to choose the person most knowledgeable about the wilderness management. In National Parks, I was sometimes referred to the resource management specialist and at other times to the research division or visitor protection division. Similar variance occurred with the Forest Service. This affected the results by providing a wider array of perceptions, depending on the duties and responsibilities of.
the interviewee. Answers must be regarded in this context. A list of manager, title, agency, wilderness area and brief description of the allocation technique is presented in Appendix B.

Prior to the interview I contacted the manager and sent a copy of the five interview questions. A preliminary set of questions was used to gather general data on the area’s particular allocation method, and to familiarize myself with the area before the interview (Appendix C).

The five interview questions were designed to cover the objectives of this study (Appendix D). They were deliberately open-ended to provide for a range of possible answers, yet also were subject to a range of interpretations. My role as interviewer was to direct the conversation for comparative data collection amongst the respondents.

The results of this study are a distillation of the practitioners’ wisdom. The primary objective is to evaluate the efficacy of, and differences between fixed itinerary and quota systems, in reducing ecological and social impacts. These two systems provide a framework for discussing the underlying issues of visitor freedom and the non-linearity of the use - impact relationship, two problematics of the use limitation approach.
CHAPTER FOUR

RESULTS

These results are a distillation of manager's responses. The type of rationing system selected affects the reduction of ecological impacts, social impacts and visitor freedom. The variation in responses suggests a diverse range of purposes and functions of use limitations but also shows how the policy responds differently depending on the context of the application and other management actions used conjunctively. The following information reveals the diversity and similarity amongst managers.

Reducing ecological impacts

Findings suggest that fixed itinerary systems have more control in reducing ecological impacts than trailhead quotas. Extensive environmental damage is reduced by concentrating use at designated campsites. Four out of five managers of fixed itinerary systems indicated that improvements ensued from concentration. Potter (Glacier N.P.) explained:

We're concentrating impact in areas we feel are most resilient, by setting up pit privy's we have a better handle on human waste, by providing places to hang food we're more able to provide safety from the grizzly bear.

Potter explained that in Glacier N.P. controlling visitor use originated with a grizzly bear study in 1967. The policy was formulated in response to management objectives of protecting wildlife and its habitat. By controlling where visitors camp, interference with the grizzly is reduced.
Other fixed itinerary systems were put in place to accommodate high levels of use all year (San Gorgonio) or throughout the summer season (Rocky Mountain N.P.; Great Smokey Mountain N.P., Mt. Rainier N.P.). Only one area, Sahuaro, experiences a short, predictable peak in use (Danisiweicz).

Shuker (San Gorgonio) gave only qualified support in his assessment of San Gorgonio's fixed itinerary system in reducing ecological impacts. Through observation of the area over the last twenty years he has noticed a decrease in the rate at which ecological damage occurs. This implies restrictions act as a holding action and is understood in context to San Gorgonio's close proximity to the Los Angeles megalopolis and consequential use pressures.

Trailhead quota's work differently to reduce ecological impacts, functioning primarily as a redistribution mechanism based on probability. Five of six managers reported overcrowding at popular destinations as the primary problem. As an example, van Wagendonk (Yosemite N.P.) described a popular lake:

It was getting pounded by hundreds of people around it, every spot was getting camped at. By limiting use we reduced the number of people ending up there each night, and reduced the number of places getting camped at.

Scott (Olympic N.P.) explains how heavily used and damaged areas at popular destinations can recover with the help of a quota:

By limiting numbers we were able to actually close and rehabilitate sites that were fragile. With fewer people there is not the need for as many sites. We could improve areas by eliminating the least acceptable sites, and create better sites away from water (Scott, Olympic N.P.).

This method of concentration through engineering (as opposed to restricting) use to appropriate sites is also used in Sequoia-Kings Canyon and Yosemite National Parks. By determining which sites visitors use most, and which ones are ecologically more
durable, rangers or managers can engineer use onto these more appropriate sites. Studies that show how visitors choose campsites can be helpful to managers in this regard (Zuckert 1980; Heberlein and Dunwiddie 1979).

Two managers indicated that use is redistributed through time and space with quota systems. A cap is put on the peak use periods - weekends and holidays - and distributed more evenly through time. More visitors plan their trips to start on week days, non-holiday week-ends (Fodor, van Wagendonk), and lighter use periods such as early and late season (Ryan).

Use is redistributed spatially too, and other areas become more impacted as a result. Managers of most trailhead quota systems were willing to accept a higher level of impact at other destinations to improve conditions at the overcrowded spots, as described by Scott and van Wagendonk (above). Quotas rely on probability and natural use dispersal patterns for this redistribution to take place.

Although redistribution of use can prevent overcrowding at certain destinations, it produces a displacement effect that can become problematic, especially when other administering bodies are affected or previously light used areas become impacted. Ryan (Alpine Lakes Wilderness) described the increased use in other parts of the Alpine Lakes Wilderness as the biggest sacrifice of implementing a quota system for the Enchantments two years ago. Use estimates of up to three hundred people a day had exceeded management plan standards for the Enchantments, and use limitations were implemented only in that area. Use pressures have increased because of the proximity to Seattle, one of the fastest growing cities in the United States. Seattle has become a popular city because it is close to many recreation areas. Some trailheads of the Alpine Lakes Wilderness are signed at freeway exits (Ryan).
A study by Shelby et al. (1989) in the Alpine Lakes Wilderness clearly shows that use is being displaced to areas not under a quota, but within the wilderness. Some of these areas had previously experienced only light use, but are now attracting moderate to heavy use levels. Ryan notes that it is becoming difficult to go anywhere in the Alpine Lakes and not see other visitors. She expects that the quota system will have to be extended to the remainder of the wilderness area in the near future. Planning for this must be done on a regional basis that involves two forests and multiple districts.

Reducing social impacts

Findings suggest that trailhead quota systems work more effectively at reducing social impacts than fixed itinerary systems. Trailhead quotas reduce social impacts by reducing the number of encounters on the trail which lowers the probability of crowding at popular destinations and thereby prevents congestion at popular destinations.

Managers of quota systems indicate they are willing to compromise some ecological improvements to protect visitor experience. Lane (Desolation Wilderness) feels their quota system "gives the best chance of providing a wilderness experience for those that go back there."

Fixed itinerary systems that provide isolated sites protect solitude while camping (Rocky Mountain N.P. some parts of Mt. Rainier N.P.), but those that provide clustered sites eliminate solitude while camping. By concentrating use to reduce the extent of environmental damage, fixed itinerary systems must then provide operational structures, including sanitation facilities, hitching rails for stock, or in places where bears present problems, food storage devices. In short, if management decides to concentrate use, it must be prepared to provide a host of other facilities which further amplifies
management presence. Stewart (1989) found that facilities, particularly sanitation facilities, were a reason for non-compliance at two National Parks with fixed itinerary systems.

Results indicate that fixed itinerary systems had more restrictive fire regulations than trailhead quotas. This can be another consequence of concentrating use. Sources of firewood become depleted when use is concentrated which causes management to slap on additional restrictions. This is not to say that wood fire restrictions result only from concentrating use. Restrictions may only reflect natural wood scarcity in alpine ecosystems.

Although all respondents felt their method of limiting use reduced both ecological and social impacts, managers of only four areas could point to studies that compared conditions over time. Robertson (John Muir Wilderness) emphasized "we think it (trailhead quotas) reduced impacts but we don't have any data or statistics to support that." He further cautions:

Wilderness management is not an exact science and I don't think we really know what we're doing. I think the biggest problem is that the reservation and quota system gives us the sense of doing a good job, the perception that the more restrictive the better job, but it might just be a bureaucratic process.... Other methods like changing access might have been just as or more effective.

This caution is striking in its candor, and good advice to any manager considering implementing use limitations. The observable problem must be linked to its cause, and strategies should be applied to the most precise cause as can be identified.

For those areas that were able to quantify improvements, the data substantiates their observation. Most significant results were from a recent study replicated in the Great Smokies that show bare soils have decreased almost 50% in ten years (Renfro). Samora
(Mt. Rainier N.P.), referred to improvements revealed in aerial photos of sub-alpine areas; and in an extensive study, Sequoia-Kings Canyon had one-third the number of campsites than pre-quota days. Olympic N.P. completed a comparative study in 1989 and although results are not yet complete, Scott expects results to indicate significant improvement at heavily used areas.

Visitor freedom

Both systems of limiting use put constraints upon visitor's freedom through restricting access. Spontaneity is lost. Fixed itinerary systems carry additional costs of infringing upon freedom of movement -- the inability of visitor's to change plans once they are inside the wilderness, and the inability to choose their own campsite.

Manager's responses suggest that when a wilderness is experiencing heavy amounts of use, there is a trade-off and balance that must be reached between visitor freedom and resource protection. A common response was that by limiting use the goals of resource protection were satisfied, and resource protection was the primary objective.

Wilderness is a place where people's convenience may be a very necessary trade-off, if that loss of convenience can provide for an enduring wilderness resource.

Van Wagtendonk (Yosemite N.P.) expressed doubt that loss of total spontaneity was a very serious sacrifice:

It is justified by what was going on back there -- the impacts both social and ecological that were occurring, and that have since been reduced due to the quota. If it were lightly used, or moderately used then you'd have a better case for it not being worth the sacrifice.

The strongest difference between fixed itinerary and trailhead systems is that trailhead quotas minimize management presence, given that some restriction on use is
considered necessary. Management presence ranges from requiring permits, to limiting access, to providing facilities and allowing developments within the wilderness. Most managers of trailhead quota systems expressed that quotas were chosen with the intended effect of having a constraint only on access thereby allowing freedom of choice and movement while in the wilderness (van Wagendonk, Fodor, Ryan).

The additional infringements of fixed itinerary systems are social impacts, and can have negative implications (Stewart 1989). Managers of fixed itinerary systems mentioned different techniques to mitigate or offset their restrictive approach. At Mt. Rainier N.P., Samora feels rangers handle the issue of freedom of choice at the enforcement level. If a visitor doesn’t have a permit, or is in a different place than their permit says, rangers try to accommodate them and adjust their permit if possible. Konz (Rocky Mountain N.P.) believes that by providing a cross country zone with no designated campsites, they have moderated the restrictiveness of the system. Rainier, Glacier and San Gorgonio also provide a cross country zone for visitors, but all indicated that these zones receive very light use.

A different opinion came from Danisiewcz (Saguaro N.P.). He justifies lost freedom of the fixed itinerary by efficiency. He comments "it could come down to dollars, if I didn’t know where people were camping that night it would cost more to patrol." This response suggests the objectives of the policy are neither resource nor visitor oriented.

One manager of fixed itinerary systems, Shuker (San Gorgonio) felt the adverse feelings that denying access creates is a sacrifice. He regrets forcing the visitor through a bureaucratic hoop: "perhaps the biggest sacrifice (of the fixed itinerary systems) is asking people for their permit on the less busy days, confronting them and having to ask them to leave if they don’t have one."
In summary, both methods of limiting use places a constraint on visitor freedom by restricting access. Managers of trailhead quota systems attempt to minimize constraints by placing a restriction only on access and allow freedom of choice and movement once inside. Fixed itinerary systems place additional constraints by limiting movement and choice once inside the wilderness. Managers of these systems tended to use other techniques to offset or mitigate the restrictions such as providing cross-country zones or by flexible enforcement.

**Amount of use versus type of use**

Critics of limiting amount of use argue that limits do not adequately reflect impacts associated with types of use (Washburne 1982). When limitation systems are structured to limit only amount of use, with no differentiation between types of use (such as stock versus foot, large parties versus small) then the system is subject to inequities if in fact these different uses have different impacts.

Manager’s responses suggest that trailhead quotas do not recognize or differentiate between types of use. Van Wagendonk (Yosemite N.P.) explained that perhaps it is a problem that the system doesn’t reflect type of use, but internal restrictions are added when it becomes necessary:

As a manager you have to look at the associated impacts, if it is indeed a situation where one kind of use is causing an inordinate amount of impact then you need to go to some more restrictive system. One of the successes of the Yosemite quota system is that it hasn’t gone to that restrictive next step; it’s restrictive enough. Some would say its already too restrictive.

Responses from managers of trailhead quota systems suggest that quotas are intended primarily to limit amount of use. Problems associated with type of use, user conflict, or visitor behavior, are dealt with separately in many of the cases. Lane, Robertson and
Fodor all mentioned that they try to alleviate these problems in other ways, mainly through education. Fodor (SEKI) mentioned reducing maximum group size in the future to eliminate some inequities of across the board quotas.

One manager of trailhead quota systems reported that their system does differentiate between types of use. Ryan (Alpine Lakes Wilderness) explained that the two main users in the Alpine Lakes Wilderness are backpackers and climbers. Climbers usually camp at the base of Mt. Stuart and leave very little trace of their camps, and since the mountain has over a hundred routes, crowding is generally not a problem. Consequently, management has excluded climbers from the quota if they are camping at the base of Mt. Stuart as a way to differentiate the impacts associated with different user groups.

Scott (Olympic N.P.) suggested that Olympic’s system does not take into account type of use because the system was established during the 1970s, and reflects primarily the carrying capacity concept of amount of use. She indicated that the Limits of Acceptable Change approach, which addresses susceptibility and sensitivity of areas, is currently being implemented. She feels this process will provide a framework for addressing types of use -- in particular, stock use -- which hasn’t been adequately dealt with under the present management plan.

Managers of fixed itinerary systems believe they address types of use adequately. Konz stated that RMNP provides opportunities commensurate with the type of needs of the visiting public. Potter (Glacier N.P.) asserted that they provide appropriate opportunities that correspond with environmental factors: they prohibit fires in areas where firewood is in short supply, prohibit stock in some areas and put only as many campsites as an area can support without too much impact or loss of privacy. Here, as
in Yosemite and SEKI, more restrictions are used to contend with the inequities of limiting amount of use only.

The mechanism of zoning was mentioned by two managers of fixed itinerary systems. Samora described zones in Mt. Rainier N.P. as providing different experiences, with different levels of solitude and challenge. In this way, opportunities and their associated impacts are segregated. Great Smoky Mountains N.P. uses zones to restrict stock use and alleviate use conflict (Renfro). Fodor (SEKI N.P.) also mentioned that a zoning approach was forthcoming in Sequoia-Kings Canyon. Instead of placing across the board restrictions upon the entire wilderness, this approach would place appropriate restrictions on given areas. Issues surrounding grazing of recreational stock users could be addressed more carefully in this way.

One manager was cautious about more restrictions. Shuker can conceive of San Gorgonio wilderness possibly rationing by group size to make things more equitable. This would alleviate the conflict between large and small groups but, "when you start getting that bureaucratic it's a hassle unless you really have a problem, and it hasn't been that big of a problem."

Other management practices

Responses from managers suggest that use limitations do not work in isolation. Instead, a combination of strategies work together to achieve reductions of impacts. This suggests that managers are attempting to be more process oriented rather than goal oriented. Lane (Desolation Wilderness) explains that the management concept of carrying capacity worked "not because it arrived at a magical number but because it was a process."
The process forces managers to define levels of acceptability. The process involved in limiting use requires a wilderness permit system that supports an education program (Scott; Robertson; Lane; Samora; Potter; Ryan; Van Wagendonk). The process involves the recognition of use patterns to define problems (Potter; Samora; Fodor; van Wagendonk). Other techniques such as revegetation, signing, and field rangers, work integrally with use limits, and without limiting use, are not as effective (Scott; Ryan; Van Wagendonk; Samora). Success of limiting use, it appears, depends on an integrative program.

All together, eleven types of practices were mentioned by all the respondents. These responses are listed in Appendix D. The presence of a wilderness ranger was the most common response. Fodor (SEKI) explained that rangers provide "the one on one contact in the wilderness, and it's out in the field where education is most effective." Scott (Olympic N.P.) also emphasized that the presence of a ranger in high use areas was critical to the program. Similarly, Robertson (John Muir Wilderness) felt that leading by example was extremely effective; a big difference came when the Forest Service began changing their own practices.

The next most common response was informational hand-outs, maps and other educational literature. Robertson (John Muir wilderness) thinks that the message "pack-it-in-pack-it-out" has been quite effective in changing peoples behavior and thus reducing impacts. The Alpine Lakes Wilderness has a theme or emphasis that changes each year (Ryan). For example, last year's theme was human waste disposal, and ranger messages, information packets and ranger station displays all emphasized human waste disposal information.
Renfro (Great Smoky N.P.) and Konz (Rocky Mountain N.P.) both recommended interpretive maps that have regulations and minimum impact information on one side, and a contour map on the other. Lane (Desolation Wilderness) commented on the effectiveness of messages as opposed to hard rules and regulations: "...lots of ethics; somehow getting the message across that wilderness is different."

The wilderness permit itself was the third most common response. Robertson (John Muir Wilderness) said "the wilderness permit itself upped the ante, so to speak, in using the wilderness and it focused a lot of attention on the wilderness." Lane (Desolation Wilderness) explained that the permit requires people to interact with the Forest Service before their hike, and is one hope to get some wilderness message across.

Trail work in the form of re-engineering trails (Fodor, SEKI), and trail restoration (Scott, Olympic N.P.) was reported to be effective. Campsite re-vegetation efforts were also though to be effective complement to limitation efforts (Fodor, van Wagendonk, Potter, Samora, Scott).

Ranger's efforts to eliminate campsites and rehabilitate is a step in preventing their re-use. Some will be re-used but people are fairly reluctant and will usually pick a used site.

In addition, all reported that specialized revegetation crews are in place to accomplish more extensive restoration. Van Wagendonk remarked that as better techniques are being developed by these specialized crews, the success of this practice has improved.

Shuker (San Gorgonio Wilderness) commented on the success of limiting access by extending a road from a trailhead that was experiencing 50% of the use. By moving it back 2 1/2 miles they discouraged people from taking that route, thus reducing impacts. They have, however, received a lot of complaints, usually about the loss of convenience. San Gorgonio also provides a non-wilderness trail where no permit is
required. This was designed to attract novice backpackers or those who would be satisfied by a primitive recreational setting as opposed to a more pristine wilderness setting.

The organizational structure of administration has had important implications for managing Glacier National Park's wilderness. Here, the resource management division is integrated, not separated from the visitor protection division. This provides for a coordinated effort between the two branches of administration. National Parks arrange themselves differently in this respect, and often the separation results in resource specialists working in the resource management division while rangers are primarily responsible for visitor protection.

**Problems, or drawbacks to the system.**

All managers felt the administrative and budgetary burden is the primary drawback to any system of limiting use. Managers of fixed itinerary systems appeared to suffer more financial pressure as a consequence of maintaining campsites and the facilities provided at the campsites (Potter, Samora).

In Great Smoky Mountain National Park administrators eliminated permit personnel during a period of decreasing use as a means of coping with budget constraints and to allow more visitor freedom. Self-issued permits for fixed itinerary campsites did not work however. The system requires precise numbers of people at sites and self-registration could not adequately control this (Renfro). Renfro feels the lack of ranger contact with the visitors was also a serious drawback of self-registration. He anticipates the reinstatement of the permit personnel in the near future.
One potential problem of trailhead quotas is that they do not affect cross country travellers. An increase in this mode of travel in Yosemite N.P. has the potential to undermine the effectiveness of quotas, and other practices will need to be employed (van Wagterendonk).

The need for coordinated management was apparent in these interviews. Ryan (Alpine Lakes Wilderness) The possible expansion of the permit program to include other areas within the Alpine Lakes wilderness will require coordination amongst districts administering the wilderness. Lane (Desolation Wilderness) commented on the problem of inconsistency amongst adjacent wilderness areas. He feels that the public has trouble differentiating political boundaries with their different rules and regulations.

Finally, Scott (Olympic N.P.) felt that the biggest problem is that the present system doesn’t go far enough. She thinks that the LAC process will help management better define problems, monitor conditions, and more precisely direct restrictions, or remove them where there are improvements. Robertson (John Muir Wilderness) also expressed the need to more precisely define problems. He see’s a danger in the present process that continues to get more restrictive as quotas don’t address the problems.

**Perceived visitor acceptance**

Invariably, all managers felt that the public approved of mechanisms to limit use. Several managers could cite studies or personal observation. Most managers felt that visitors were positive initially and continue to be because they accept constraints on freedom for the higher quality of wilderness that results (Scott, Fodor, Renfro, van Wagterendonk, Lane). Robertson (John Muir Wilderness) felt that the public has generally
accepted quotas and restrictions because it gives them a sense of doing something to protect the wilderness.

Some managers used lack of negative feedback as criteria for public acceptance of the policy (Konz, Potter, van Wagendonk, Samora). Actual field evaluation of user satisfaction had been done in only a few instances. Van Wagendonk noted that although users responded favorably in two studies of user satisfaction in Yosemite, opinion polls are not going to give you a complete picture: "all your getting is what people are willing to say in reaction to your question." This is supported by Stewart’s (1989) study that found users expressed acceptance to use limitation policy but were not complying with it. Coping behavior and displacement of visitors that choose to go to another area, or are denied access, also affect results of a satisfaction survey of those who visit the area. Shelby et al.’s (1989) study was interesting in this respect because it was able to survey people who were denied access. It gathered information on substitute settings, effects of wilderness experience and activity preference, and displacement reaction.
CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND MANAGEMENT IMPLICATIONS

This study set out to evaluate the effectiveness of limiting use in wilderness areas. The objectives of this study were to determine:

-- The efficacy of and differences between quotas and fixed itinerary systems.
-- The administrative and political costs of these systems.
-- The perceived visitor acceptance of the restrictions.
-- Other management practices that are used in addition to limiting use and are effective in reducing impacts.

The categories of fixed itinerary and trailhead quota represent two types of methods amidst a range of actual possible applications. This paper identifies these two categories recognizing that actual practices combine and vary their system to accommodate the particular character and attributes of the area. Those that are listed as trailhead quotas often have some areas where there are designated campsites. For this reason the cases in this study are viewed in terms of their primary method.

Summary Conclusions

Fixed itinerary systems reduce ecological impacts through concentrating use. The implication of this action is increased management presence. Once use is concentrated, further management actions must follow, possibly including hardened sites, sanitation facilities, hitching rails, and bear food storage devices. There is also the prospect of eventually having to restrict wood fires as a result of firewood depletion caused by
concentration. Opportunities for solitude while camping are enhanced when sites are isolated, but eliminated when sites are clustered. Freedom of choice in campsite selection and travel routes is also eliminated.

Trailhead quotas are more effective at reducing social impacts associated with use. Managers of trailhead quotas optimize visitor choice and freedom, given that use must be limited. This happens by placing restrictions on access, not on movement once inside the wilderness. Trailhead quota systems work primarily through redistribution of use temporally and spatially. By reducing use management has the opportunity to restore damaged areas, and engineer visitors on to more durable sites. One trade-off of both systems, but to a greater degree trailhead quotas, is displacement. Many managers of trailhead quotas were willing to accept more impact at other places to prevent overcrowding at the traditional popular destinations. In cases like the Alpine Lakes Wilderness displacement becomes more problematic because the displaced use crosses political boundaries, and/or creates more problem areas.

Findings substantiate charges that limiting use through a trailhead quota does not take into account types of use (Washburne 1983). Most managers relied upon other restrictions or management actions to solve these other problems, emphasizing amount of use was the primary problem quotas were intended to solve. One area, Alpine Lakes wilderness, excluded one user group, climbers, from the quota as a way to alleviate inequities of an across the board quota system.

For many that did differentiate between type of use, zoning was used to manage a diversity of uses (Samora, Renfro, Fodor). Fodor anticipated SEKI possibly moving towards a zone approach to differentiate regions by vegetation and use patterns and
different restrictions would apply to these different zones. Scott (Olympic N.P.) also mentioned the possibility of using a zone perspective to assist in designing strategies.

The primary administrative problem is the budgetary burden. The more apparatus required the more demand for money to keep it going. To an extent all systems experience this cost, but fixed itinerary systems require more structures and functions than trailhead quotas.

Political problems that are associated with these systems involve interagency and regional co-ordination. To alleviate the conflicts and complexities of multiple jurisdiction, inter-agency communication is needed to handle the broader issues.

All managers felt their systems were accepted by the visiting public. Several managers could site studies to substantiate this. Lack of negative feedback was more commonly used as criteria by managers of fixed itinerary. These findings are not substantiated by other studies (Stewart 1989) and may indicate coping behavior, displacement or lack of correct management perception of visitor attitudes.

Finally, use limitations do not work in isolation. Managers listed many actions that work integrally with limitations to reduce impacts, they are listed in Appendix E. Managers indicated that education programs are essential for overall, long-term effectiveness in reducing impacts. Opportunities for one and one contact with the visitor through permit system and/or ranger patrols are considered fundamental and vitally important.

**MANAGEMENT IMPLICATIONS**

**Consequences of limiting use:** Managers implementing use limitations contend with the sequence of actions that necessarily follow. For fixed itinerary systems it means the
hardening of sites and facilities to accommodate concentrated use. These impose a management presence that contributes to social impacts.

Trailhead quotas must contend with displaced use and be willing to accept more impact in other places as a result of redistributing use away from overcrowded areas. Quotas also tend to become more restrictive when the quota does not address other problems, which often leads to additional internal constraints.

Managing use and impacts requires trade-offs. Managers must define their goals and objectives in terms of what impacts they are willing to accept and what constraints they are willing to impose on visitor freedom.

**Finding solutions to the cause:** The goal of finding an acceptable balance between visitor freedom and resource protection requires identifying the historical context of the problem and addressing the cause. In most cases in this study, too much use was the identified cause of problems managers were attempting to solve. The few exceptions are noteworthy. In Saguaro National Park, where justifications for limiting use was efficiency of ranger patrols, and use only infrequently reaches high levels, management actions were not directed at the cause.

Robertson (John Muir Wilderness) mentioned that other actions might have been used before jumping to use limitations: "it's expensive and time consuming; it takes money which could have hit the ground in form of rangers or research." He expresses the danger of fusing plans and regulation when following a management plan direction that dictates actions: "capacities were until recently the state of the art management technique, if you were imposing a quota you were doing your job."
This comment holds important implications for the planning process. With the traditional carrying capacity approach there was an overemphasis on use. When it was determined that amount of use was too complex of a variable to understand fully, some managers turned to using impacts as a more accurate indicator of change and problem identification. When it comes to problem solving however, management may need to look at both use and impacts, and understand the dynamics between the two elements.

Van Wagtendonk expresses the process of determining management actions like this:

Even low levels of use cause impact, that is true, but it gets back to how much impact is acceptable. Management has to decide that this level of impact is unacceptable or, up to this point it is acceptable. Beyond that you start looking at what's causing the problem. I think that's what you really have to do, what is it that's causing the problem.

Long-term solutions will come only through addressing causes, not symptoms of the problems.

**Systems context:** There is an issue between concentrating use and distributing use. The danger is in generalizations. In areas such as Glacier National Park where the grizzly bear patterns consider into visitor management, or Mt. Rainier where trails converge onto one mountain with fragile alpine and subalpine ecosystems, concentrating use may be a viable strategy. In areas of sustained heavy use, concentrating use may also be a viable strategy. Each case has unique attributes and a historical context that contribute to the use-impact affect. This points to the need for a method that evaluates conditions and their acceptability in a flexible and prescriptive way. The Limits of Acceptable Change framework, Recreational Opportunity Spectrum, and other zoning methods can be quite helpful in providing a process by which standards can be defined. Without a vision of what conditions or relations we wish to establish with the land, management
will be random thrusts at whatever is the current problem. Social and ecological variables must be understood independently as much as within the context of the whole system and broader issues.

**Visitor freedom and authenticity:** The mission of wilderness managers becomes important to define particularly with the issue of visitor freedom. Managers in this study indicated their primary objective is resource protection, and visitor freedom is second. The trade-off between freedom and resource quality is a very real:

visitors can go to adjacent Forest Service areas if they don’t like fire restrictions or no pets. There is more freedom but of course where there is more freedom impacts are more severe (Samora, Mt. Rainier).

The role of managers is to translate law into policy. The balance between recreational use and resource impacts relies upon a blending of subjective and objective criteria. Managers of wilderness must be particularly sensitive to the philosophical implications of management actions, and must strive for more co-ordinated goals to achieve successful stewardship of the wilderness resource.

The danger of not doing anything, or of not doing enough, is that the quality of the experience will gradually erode and tolerance levels for both ecological and social impacts could also drop. If wilderness persists as a symbol that reflects cultural and social values, policies geared towards sustaining that symbol will only achieve a simulation of wilderness. Perhaps we need to simulate because we have already lost a lot of what wildness stands for:

**Wilderness, wilderness...** We scarcely know what we mean by the term, though the sound of it draws all whose nerves and emotions have not yet been irreparably stunned deadened, numbed by the caterwauling of commerce, the sweating scramble for profit and domination. Why such allure for the very word? What does it really mean? Can wilderness be defined in the word of government officialdom as simply ‘A minimum of not less than 5000 contiguous acres of roadless area.’ ? This much
may be essential in attempting a definition, but it is not sufficient; something more is involved. (Abbey 1968; pg. 189)

**Fragmented management:**

There is a growing realization, noticeable in the responses in this study, that political boundaries are thwarting our ability to manage land use and values in late twentieth century society. The boundaries of wilderness claim a separation, and management follows with agency directives and missions influencing management practices. The fact that policies such as limiting use have so many purposes and applications exemplifies the way in which policies can be reactionary or expedient without being directly purposeful. The value of wilderness and the translation of this value to agency mission has created a wilderness that often promotes a separation between nature and humans: we are visitors and our impacts are often considered unacceptable.

The possibility of deconstructing the political boundaries will no doubt become important in the decades ahead. The challenge for managers to address mission, and to have a vision that binds all wilderness managers, will require astutely reflecting on the relation between humans and the environment.

Managers and researchers of all ecosystem disciplines, and particularly wilderness, must welcome a dose of subjectivism, that makes valuing an activity of subjects, not merely objects (Weston 1985). The issues that will confront wilderness managers in the future will be the ultimate evaluation of use limitation policies. Like other land managers, how well they deal with transboundary issues and the complexity of the use-impact relationship will determine their success.


Lime, D.W. 1977. When the wilderness gets crowded...?


_________. 1982. Recreation Regulations - When are they needed? J. of For. 80(3): 148-151


Stankey G.H. 1973. Visitor perception of wilderness recreation carrying capacity. USDA Forest Service research paper INT-142, Intermountain Forest and Range Experiment Station; Ogden UT.


_________. and J. Baden. 1977. Rationing wilderness use: methods, problems and guidelines. USDA Forest Service research paper INT-192, Intermountain Forest and Range Experiment Station; Ogden UT.


APPENDIX A

AMOUNT OF USE

The general relationship between amount of use and
loss of vegetation cover for (a) a fragile vegetation type and (b) a
more resistant type.

NIGHTS OF USE/YR

Relationship between amount of
use and (a) tree damage; (b) loss of vegeta-
tion cover; (c) increase in penetration resis-
tance; (d) increase in exposed roots, mineral
soil, and rock; and (e) campsite area on
campsites in the Boundary Waters Canoe
Area (Marion 1984).

Graphs from Cole, D.N. 1987. Research on soil and vegetation in wilderness: A state-of-
knowledge review. Proceedings—National wilderness research conference: issues, state-of-
knowledge, future direction; 1983 July 23-26; Fort Collins, CO, General Technical Report INT
220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research
Station: 155-157.
APPENDIX B

Interview respondents, agencies and areas using fixed itinerary and quota allocation methods.

<table>
<thead>
<tr>
<th>FIXED ITINERARY</th>
<th>Agency</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike Danisweicz</td>
<td>NPS</td>
<td>Saguaro Nat’l Monument</td>
</tr>
<tr>
<td>Wild. Sub-Distr. Ranger</td>
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<td></td>
</tr>
<tr>
<td>Leon Konz</td>
<td>NPS</td>
<td>Rocky Mountain Nat’l Park</td>
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<tr>
<td>Resource Mgmt. Specialist</td>
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<td></td>
</tr>
<tr>
<td>Jack Potter</td>
<td>NPS</td>
<td>Glacier Nat’l Park</td>
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<tr>
<td>Backcountry Specialist</td>
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<td></td>
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<tr>
<td>Jim Renfro</td>
<td>NPS</td>
<td>Great Smoky Mtns. Nat’l Park</td>
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<tr>
<td>Biological Technician</td>
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<td></td>
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<tr>
<td>Barbara Samora</td>
<td>NPS</td>
<td>Mt. Rainier Nat’l Park</td>
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<td>Resource Mgmt. Specialist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bob Shuker</td>
<td>USFS</td>
<td>San Gorgonio Wilderness /</td>
</tr>
<tr>
<td>Wild. &amp; Disp. Area Manager</td>
<td></td>
<td>San Bernadino Nat’l Forest</td>
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<table>
<thead>
<tr>
<th>QUOTA</th>
<th>Agency</th>
<th>Area</th>
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<tbody>
<tr>
<td>Paul Fodor</td>
<td>NPS</td>
<td>Sequoia/Kings Canyon Nat’l Park</td>
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<td>District Ranger</td>
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<td>Don Lane</td>
<td>USFS</td>
<td>Desolation Wilderness</td>
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<td>Assis. Rec. Staff Officer</td>
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<td>El Dorado N.F./ Tahoe Basin Rec. Area</td>
</tr>
<tr>
<td>Dudley Robertson</td>
<td>USFS</td>
<td>John Muir Wilderness</td>
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<tr>
<td>Rec. Wild. Officer</td>
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<td>Sierra Nat’l Forest</td>
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<td>Chris Ryan</td>
<td>USFS</td>
<td>Alpine Lakes Wilderness</td>
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<td>Ruth Scott</td>
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<tr>
<td>Jan van Wagendonk</td>
<td>NPS</td>
<td>Yosemite Nat’l Park</td>
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<td>Research Scientist</td>
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</table>
APPENDIX C

PRELIMINARY QUESTIONS

WILDERNESS AREA__________________________________________

ADMINISTRATION : NPS_____ USFS_____

CURRENT MANAGER, TITLE, PHONE NUMBER:____________________

________________________________________________________________________

TYPE OF USE LIMITATION:

SEASON OF RATIONING:

IF THERE IS A RESERVATION SYSTEM WHAT IS THE NO-SHOW RATE.

IS THIS (THE NO-SHOW RATE) A PROBLEM? HAS ANY THING BEEN CONSIDERED OR DONE TO REDUCE THIS RATE?

WHAT IS THE VISITOR COMPLIANCE RATE FOR WILDERNESS PERMITS? (%)

GENERALLY, WHAT HAS BEEN THE USE TREND SINCE 1980? UP, DOWN, STABLE, FLUCTUATING.

DO YOU HAVE RESTRICTIVE ZONES SUCH AS NO WOOD FIRES, STOCK, ETC?
Interview Questions to Managers

1) Does limiting use through trailhead quota’s / designated campsites reduce a) ecological and b) social impacts caused by human use? If so, what specific improvements can you credit with the implementation of your method?

2) What has been sacrificed in implementing the particular rationing system, and how is this sacrifice justified?

3) How does your method recognize and reflect the varying degrees of impacts associated with the various types of use?

4) What other management practices are used and have proved to be effective in reducing social/ecological impacts?

5) What drawbacks, shortcomings or problems does your system impose, if any?
**APPENDIX E**

Other practices managers considered effective in reducing social and/or ecological impacts.

<table>
<thead>
<tr>
<th>Management Practice</th>
<th># Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilderness Ranger</td>
<td>8</td>
</tr>
<tr>
<td>Wilderness Permit</td>
<td>6</td>
</tr>
<tr>
<td>Informational handouts</td>
<td>6</td>
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<tr>
<td>Revegetation</td>
<td>5</td>
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<tr>
<td>Signs</td>
<td>4</td>
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<tr>
<td>Minimum impact messages</td>
<td>3</td>
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<tr>
<td>Interpretive program</td>
<td>2</td>
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<tr>
<td>Trail engineering</td>
<td>2</td>
</tr>
<tr>
<td>Monitoring</td>
<td>2</td>
</tr>
<tr>
<td>Providing non-wilderness opportunity</td>
<td>1</td>
</tr>
<tr>
<td>Reducing access by extending trail</td>
<td>1</td>
</tr>
<tr>
<td>Other restrictions on use</td>
<td>1</td>
</tr>
<tr>
<td>Leading by example</td>
<td>1</td>
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</tbody>
</table>