

# 12 Visitor Management

It is useful to distinguish between visitor management techniques and site management techniques. However, the distinction between the two is not perfect. Site manipulation can be a potent means of managing the amount and distribution of visitor use, and manipulation of where visitors go can be an effective means of managing site condition. For our purposes we will restrict visitor management to regulation, information, and education designed to influence the amount, type, and timing of use, visitor behavior, and the extent to which use is dispersed or concentrated. Site management involves management of where use occurs, as well as physical manipulation of the resource.

Although images of trail building and facilities may first spring to mind when we think of impact management, visitor management is generally the first line of defense. Regulations—the “do’s and don’ts” on park signs—and the information that comes in brochures and from contacts with rangers do the bulk of the job in controlling visitor impact. This is particularly true in legally designated wilderness. In wilderness, extensive engineering and environmental modification and strict control of where use occurs are undesirable. As we move away from the primitive end of the opportunity spectrum, the appropriateness of facilities, engineering, and extensive environmental modification increases. In developed campgrounds, for example, site management may rival visitor management in importance. Even here, however visitor management techniques, such as restrictions on the number of people or prohibition of dogs or horses, are critical to managing impact.

Although management of the amount, type, and behavior of users is often critical to effective management of recreational impacts, managers must never forget the interests and desires of their recreational clientele. After all, much of the manager’s job should be directed toward maximizing visitor satisfaction. It is important to temper a concern for resource protection with a concern for promoting recreational opportunities. The relative importance of these two concerns will vary from area to area, along with management goals and objectives.

The visitor management techniques described in this chapter are organized by strategic purpose, as discussed in Chapter 10. A wider variety of visitor management techniques is potentially useful in large recreation areas toward the primitive end of the recreation opportunity spectrum. Therefore, many of the techniques described in this chapter are most applicable to backcountry areas. In fact, most of the examples are taken from wilderness, where research on how visitor management can be used to reduce impacts has been particularly active. The opposite is the case

with site management. Many of the techniques described in Chapter 13 will be of limited utility in wilderness, where intensive and extensive site modification is inappropriate.

## USE LIMITS

Although limiting use will be the first technique discussed, it should not be the first line of defense against impact. Reducing use can be a convenient way to limit impact without either having to understand the real cause of problems or getting involved in more direct and active management of problems. However, use limitations conflict with one of the primary objectives of recreation management—providing opportunities for recreational use and enjoyment. It is justified in places where demand is so great that there is little alternative to use reductions or where the only other option is a program of numerous restrictions that preclude many preferred uses. However, other options should be explored first. Use should be limited only after a thorough analysis shows that it is the best way to avoid both unacceptable levels of impact and a program of restrictions that would eliminate much of the joy of visiting the area.

Because the relationship between amount of use and amount of impact is not linear, reducing use will not necessarily reduce impact substantially. A little use causes considerable impact, and further increases in use have less and less additional effect on the resource. On already impacted sites all use may have to be curtailed before recovery can occur. In fact, in some situations, such as on incised trails where erosion is occurring, even elimination of all use may be ineffective. Active site rehabilitation may be necessary before any recovery occurs.

In popular places, where use levels are high—the most common situation where use reductions have been applied—changes in amount of use will usually have more of an effect on the *number* of impacted sites than on the *severity* of impact on individual sites. Consider the example of a popular wilderness lake basin with 10 campsites. Limiting use to a maximum of five parties per night would probably not reduce use of any of these sites to the point where recovery could occur. However, there would no longer be need for more than five campsites in the basin. Therefore, if managers closed five of these sites, the number of impacted sites would eventually be reduced by the cutback in use. Not only is the severity of impact on individual sites not reduced, but without the supporting action of closing certain campsites, even the number of sites would not have been affected. Use reductions in high-use areas are a justifiable means of avoiding crowding but are less useful in avoiding ecological impacts. Where implemented, they must be complemented with a use concentration program to have any ecological benefit at all. In developed recreation areas, use limitation is also a means of seeing that the physical capacity of the area (the number of available campsites, for example) is not exceeded.

In lightly used areas the situation is quite different. Remember that at low-use levels, differences in amount of use can have significant effects on amount of impact. If use levels can be kept very low, the severity of impact will also be very low. In such a situation, use limitations can contribute substantially to maintaining low levels of

impact. The trick is to keep use low on all sites and to make sure that visitors avoid fragile sites and do not engage in highly destructive behaviors. Even one party of vandals can inflict serious damage. Therefore, a program of use limitation in low-use areas—to keep impact levels very low—will be effective only if supported by programs that teach visitors to choose lightly used, resistant recreation sites and to practice low-impact techniques. We will discuss these actions, use dispersal and visitor education, in more detail later. Such a program is probably justified only in wilderness-type areas where only very low levels of impact are acceptable.

Most research and much of the controversy surrounding use limitation is concerned with decisions about when and how use limits should be implemented. Visitors usually support use limits if they believe they are necessary to protect resources (McCool and Christensen 1996). However, when visitors are asked whether or not current impact problems warrant use limits, they often disagree. For example, visitors to Snow Lake (a very heavily used lake in the Alpine Lakes Wilderness in Washington) were asked their opinion about the need for use limits. Only 18 percent replied that there should not be use limits regardless of amount of use or impact. Of those who thought use limits might be needed at some time, 48 percent believed they were needed now and 52 percent replied that limits were not needed now but would be justified if overuse occurred in the future. Moreover, those people who thought limits were needed now were divided equally between those who believed use should be reduced and those who thought use should be kept to current levels (Cole, Watson, Hall, and Spildie 1997).

Once it is decided that use limits are needed, someone must make decisions about maximum acceptable amounts of use. Many different criteria and considerations have been employed in setting these limits. There is substantial controversy over the extent to which empirical data can be directly translated into use limits. Some scientists have employed the concept of social norms as a basis for setting use limits. They hold that most visitors share common opinions about the conditions that ought to exist in recreation areas (these are termed *norms*), that the norms can be determined from visitor surveys, and that these norms can be the basis for use limits (Shelby, Vaske, and Donnelly 1996). Other scientists disagree. They question whether visitor opinions about conditions are really norms (Noe 1992), whether most visitors are “merely guessing” about what they think conditions ought to be (Williams, Roggenbuck, Patterson, and Watson 1992), and the extent to which the opinions of current visitors should be the primary basis for limits.

Use limits in the backcountry of Yosemite National Park, California, were established for each travel zone in the park, based on acres in the zone, miles of trail, and an ecological fragility factor—derived from an assessment of ecosystem rarity, vulnerability, recuperability, and repairability (van Wagtenonk 1986). In the neighboring Sequoia and Kings Canyon National Parks, California, use limits were based primarily on an analysis of existing campsites (Parsons 1986). The number of well-impacted campsites was tallied for each zone. Sites that were within 25 ft of water, within 100 ft of another well-impacted campsite, or otherwise considered unacceptable were deleted from the tally. This tally of “acceptable” campsites was used to define the maximum number of groups that should be in a zone at any one time.

It is our opinion that use limits are subjective judgments. They must be developed by managers, with input from legitimate stakeholders. Science can only inform these decisions, by assessing resource conditions and visitor opinions and describing likely outcomes of alternative decisions. We advocate an approach such as the Limits of Acceptable Change process. Once managers make subjective decisions about maximum acceptable levels of impact, scientists can assess the relationships between amount of use and amount of impact. Levels of use that can be sustained without exceeding limits of impact can be identified. Simulation models and computer programs can be developed that allow managers to set limits on the number of people entering at specific trailheads, such that impact levels within the wildland area remain below maximum acceptable limits (van Wagtenonk and Coho 1986).

Once use limits are established, the issue of allocation emerges. On white-water rivers, the allocation of a limited number of permits between commercial and private users is a highly controversial issue (McCool and Utter 1981). Elsewhere most of the controversy revolves around several mechanisms for allocating permits to private users. Permits can be requested in advance through some sort of reservation system. For example, permits to camp in Yosemite National Park can be reserved through a commercial booking and reservation service. An alternative is to issue permits to visitors on a first-come, first-served basis when they arrive at the area. When capacity is reached, additional visitors must be turned away. When demand for permits is many times greater than the number available, lotteries are sometimes used to determine who gets a permit. This is a common means of allocating permits for river trips. People desiring permits submit an application, noting their preferred dates for departure. Then, applications are picked randomly, up to the maximum allowable number, and those parties selected are issued permits. By attaching a fee to a permit or requiring some minimum level of skill or knowledge before qualifying for a permit, demand can be reduced. These can also be a means of rationing (limiting) use.

Each of these methods has certain advantages and disadvantages. Some benefit certain users and are costly to others. Costs to administer are variable, as is the acceptability of the method to visitors. Stankey and Baden (1977) evaluated the pros and cons of each of these means of limiting use. Although they were specifically concerned with rationing wilderness use, their conclusions also apply to other wildland recreation areas. Table 1 summarizes their conclusions. Stankey and Baden (1977) advance five general guidelines to consider in limiting use:

1. Start with an accurate base of knowledge about use, users, and impacts.
2. Reduce use levels only when less restrictive measures are unlikely to solve the problem.
3. Combine rationing techniques (e.g., issue half of the permits through advance reservation and half first-come, first-served on arrival) to minimize and equalize costs to users and administrators.
4. Establish a system that tends to allocate permits to those people who place the highest value on the permit.
5. Monitor the use limitation program to make sure it is solving problems and is fair.

**TABLE 1. Evaluation of Impacts and Consequences of Alternative Systems for Rationing Use**

Rationing System	Evaluation Criteria			
	Clientele Group Benefited by System	Clientele Group Adversely Affected by System	Experience to Date with Use of System in Wilderness	Acceptability of System to Wilderness Users
Request (Reservation)	Those able and/or willing to plan ahead; i.e., persons with structured life-styles.	Those unable or unwilling to plan ahead; e.g., persons with occupations that do not permit long-range planning, such as many professionals.	Main type of rationing system used in both National Forest and National Park wilderness.	Generally high. Good acceptance in areas where used. Seen as best way to ration by users in areas not currently rationed.
Lottery (Chance)	No one identifiable group benefited. Those who examine probabilities of success at different areas have better chance.	No one identifiable group discriminated against. Can discriminate against the unsuccessful applicant to whom wilderness is very important.	None. However, is a common method for allocating big-game hunting permits.	Low.

*(continued)*

TABLE 1. (Continued)

Rationing System	Evaluation Criteria			
	Clientele Group Benefited by System	Clientele Group Adversely Affected by System	Experience to Date with Use of System in Wilderness	Acceptability of System to Wilderness Users
Queuing (First-come first-served)	Those with low opportunity cost for their time (e.g., unemployed). Also favors users who live nearby.	Those persons with high opportunity cost of time. Also those persons who live some distance from areas. The cost of time is not recovered by anyone.	Used in conjunction with reservation system in San Jacinto Wilderness. Also used in some National Park wildernesses.	Low to moderate.
Pricing (Fee)	Those able or willing to pay entry costs.	Those unwilling or unable to pay entry costs.	None.	Low to moderate.
Merit (Skill and knowledge)	Those able or willing to invest time and effort to meet requirements.	Those unable or unwilling to invest time and effort to meet requirements.	None. Merit is used to allocate use for some related activities such as river running.	Not clearly known. Could vary considerably depending on level of training required to attain necessary proficiency and knowledge level.

Evaluation Criteria				
	Difficulty for Administrators	Efficiency—Extent to Which System Can Minimize Problems of Suboptimization	Principal Way in Which Use Impact Is Controlled	How System Affects User Behavior
Request (Reservation)	Moderately difficult. Requires extra staffing, expanded hours. Record keeping can be substantial.	Low to moderate. Under utilization can occur because of “no shows,” thus denying entry to others. Allocation of permits to applicants has little relationship to value of the experience as judged by the applicant.	Reducing visitor numbers. Controlling distribution of use in space and time by varying number of permits available at different trailheads or at different times.	Affects both spatial and temporal behavior.
Lottery (Chance)	Difficult to moderately difficult. Allocating permits over an entire use season could be very cumbersome.	Low. Because permits are assigned randomly, persons who place little value on wilderness stand equal chance of gaining entry as those who place high value on opportunity.	Reducing visitor numbers. Controlling distribution of use in space and time by number of permits available at different places or times, thus varying probability of success.	Affects both spatial and temporal behavior.

(continued)

TABLE 1. (Continued)

	Evaluation Criteria			
	Difficulty for Administrators	Efficiency—Extent to Which System Can Minimize Problems of Suboptimization	Principal Way in Which Use Impact Is Controlled	How System Affects User Behavior
Queuing (First-come first-served)	Low to moderate difficulty. Could require development of facilities to support visitors waiting in line.	Moderate. Because system rations primarily through a cost of time, it requires some measure of worth by participants.	Reducing visitor numbers. Controlling distribution of use in space and time by number of persons permitted to enter at different places or times.	Affects both spatial and temporal behavior. User must consider cost of time of waiting in line.
Pricing (Fee)	Moderate difficulty. Possibly some legal questions about imposing a fee for wilderness entry.	Moderate to high. Imposing a fee requires user to judge worth of experience against costs. Uncertain as to how well use could be "fine tuned" with price.	Reducing visitor numbers. Controlling distribution of use in space and time by using differential prices.	Affects both temporal and spatial behavior. User must consider cost in dollars.
Merit (Skill and knowledge)	Difficult to moderately difficult. Initial investments to establish licensing program could be substantial.	Moderate to high. Requires users to make expenditures of time and effort (maybe dollars) to gain entry.	Some reduction in numbers as well as shifts in time and space. Major reduction in per capita impact.	Affects style of user's behavior.

Source: Stankey and Baden 1977.



Both the type of use being limited and where the limitations are applied can vary. In many places overnight use is limited but day use is not. In two-thirds of the national parks that limit backcountry use, limits apply only to overnight users (Marion, Roggenbuck, and Manning 1993). This may be justifiable, from an ecological standpoint, where campsite impacts present problems but trail impacts do not. Campsite impacts are caused almost entirely by overnight users, whereas trail impacts are caused by both overnight and day users. It is also common to limit permits to float rivers but allow unlimited backpacking in the same area. This is a result of high demand for limited space along the river corridor and low demand elsewhere.

In large nonroaded areas there is an important difference between (1) programs that limit entry to an area but permit free travel once entry has been obtained and (2) programs that issue a limited number of permits for specific campsites or zones within the area. In this latter case free and spontaneous movement within the area is curtailed because visitors are required to stick to itineraries they agree to before entering the area.

Entry quotas are not as efficient as fixed itineraries in controlling use levels at popular interior locations. Use levels in the interior are affected both by how many people enter the area and by the routes they travel and the places where they choose to camp within the area. Within limits, however, use distribution patterns are consistent and predictable. Therefore, it is possible to devise trailhead quotas that keep use levels at interior locations close to desired levels (van Wagendonk and Coho 1986). Although less efficient, this means of rationing has the advantage of allowing visitors free choice to move about as they please and change their routes and activities in response to circumstances they encounter (such as blisters, bad weather, or new destinations that they see on a map or from some viewpoint).

These freedoms are taken away where visitors are required to stick to fixed itineraries (where limited permits are issued for either specific campsites or zones). Currently, this is a common practice in the backcountry of some of the popular national parks, such as Glacier, Yellowstone, Rocky Mountain, Great Smoky Mountains, and Mt. Rainier. Visitors to these parks must state where they are going to camp every night they are in the backcountry. Assuming there are openings available, they are issued a permit to camp in the specific places they have reserved. There is no opportunity, legally, to change their minds even if they overestimated their abilities or if bad weather sets in. With such a program, administrative costs climb because rangers must patrol more widely to make certain that visitors are keeping to their itineraries. At Grand Canyon National Park, about one-half of all parties deviate from their itineraries and, therefore, are subject to citation (Stewart 1989).

Both increased administrative costs and loss of visitor freedom are accepted for an increase in efficiency. Because use distribution is more tightly controlled at the interior locations of concern, there is less chance that desired use levels will be exceeded. In most situations, however, carrying capacities are sufficiently arbitrary to make this difference in level of efficiency of little importance. Moreover, the low level of compliance suggests that the perception of a tight control on use distribution is illusory. Trailhead entry quotas may be equally effective, simpler to implement, and less burdensome to visitors (Stewart 1989).

Several studies have asked visitors for their opinions about the acceptability of various use limitation techniques, particularly in wilderness and on white-water rivers. Most visitors accept use limits if they are necessary to prevent overuse. In San Jacinto and San Geronimo Wildernesses in California, even parties that did not receive permits and were denied access to the area generally thought the use limits were appropriate (Stankey 1979). Visitors generally prefer rationing techniques with which they are familiar. Lottery is looked upon unfavorably in most wildernesses (Stankey and Baden 1977), but it is acceptable on rivers such as the Middle Fork of the Salmon where it has been used successfully for many years (McCool and Utter 1981). Fixed itineraries are one of the most disliked of all management alternatives in wildernesses without permit systems (Lucas 1980). At Grand Canyon National Park, however, less than 10 percent of visitors had negative feelings about the existing fixed itinerary system (Stewart 1989).

Finally, managers and users may differ in their opinions about alternative rationing techniques. In a study of river users and managers, Wilke (1991) found that users were more accepting of reservation and merit systems than managers. Managers favored a lottery system. Neither group favored a system based on pricing.

Permits can be used for purposes other than to limit use. They can provide valuable information about users. For example, permits used in Forest Service Wilderness collect data on size of the group, where the party leader lives, main method of travel, date of entry and exit, and location of entry and exit. It is also possible to obtain a rough idea of the party's travel route, although there is no obligation to stick to this itinerary.

Such information can be useful in developing management programs suited to a particular clientele. Permits also provide a means of establishing contact with the user in order to either pass along information or clearly state regulations in force in the area. They can be used for safety purposes as well. If members of a party get lost, a permit can alert managers to their predicament and help locate them. However, this potential use of permits or a registration system is often not used to advantage because managers do not check for returned permits. This should probably be made clear to visitors who may think they will be rescued if they do not come out by a certain date.

Visitors are generally receptive to nonrationed permits if they are convenient to obtain. For example, in nine wilderness and roadless areas in Montana and California, no more than 15 percent of users found mandatory registration to be undesirable (Lucas 1980). However, compliance with permit systems is highly variable. Compliance is greatest when permits are mandatory and easy to obtain. Self-issued permits at trailheads are a convenient alternative to requiring visitors to come to agency offices during specific hours (Fig. 1). Hendee, Stankey, and Lucas (1990) report compliance rates of 91 to 95 percent with self-issued permits in wilderness.

## LENGTH OF STAY LIMITS

Use levels can also be reduced by limiting the amount of time visitors can spend in the area. Length of stay limits have been placed on time spent both in the entire recreation area and at specific sites within the area. Areawide limits are unlikely to have



**FIGURE 1.** Visitors can obtain a free but mandatory permit at this trailhead station. Information on low-impact use techniques, visitor safety concerns, rules, and regulations can be communicated to the visitor at the same time. (Photo: R. C. Lucas.)

any effect on site impacts. Such limits are probably justified when there is heavy demand for a limited amount of use. More groups can be accommodated—fewer are denied access—if stays are short. In the heavily used Rae Lakes basin in Kings Canyon National Park, California, a one-day-stay limit allowed more people to visit the area, and total use and impact declined (Parsons 1983).

Length of stay limits for specific sites are also likely to have little effect on impact levels if those specific sites are popular. It makes little difference whether one party uses a site for seven days or if seven parties use it for one day. The main effect of such a limit is to keep anyone from “homesteading” a particular site. If demand for a specific site is high, a length of stay limit will allow more parties to use the site. These reasons, to prohibit homesteading and to allow access to more parties, are probably the most common ones for length of stay limits, particularly in more highly developed recreation areas.

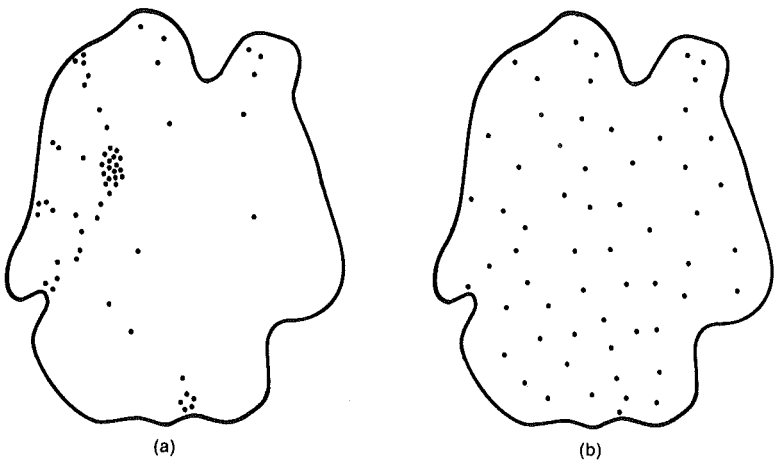
In terms of managing ecological impacts, the most important place to impose length of stay limits is in lightly used places, particularly wilderness areas. In places where dispersal is the policy—to avoid substantial impact on all sites—a long stay in one place can cause unacceptable impact. Where dispersal is practiced, length of stay limits should be no more than a night or two at individual sites. No areawide limits are needed, however, and there should be no need to impose a regulation. Dispersal will be effective only if visitors are highly conscientious about minimizing impact.

Keeping their stays at individual sites short should be one of the techniques that all conscientious campers use to keep their impact to a minimum.

## DISPERSAL OF USE

The high level of use concentration in popular parts of dispersed use areas is often blamed for ecological impact problems. For example, in a survey of wilderness managers, Washburne and Cole (1983) inquired about their most significant problem. The most frequent response was "local resource degradation and lack of solitude as a result of concentrated use." The most frequently mentioned "most effective" management technique for dealing with significant problems was personal contact with visitors, leading to increased use dispersal. Dispersal, however, can mean different things to different people. Think about camping, for example. Dispersal could involve (1) spreading people out on the same number of campsites but with greater distance between parties, (2) spreading people out on more sites with or without increasing the distance between parties, or (3) spreading people out in time (increasing off-season use) with or without changing spatial distribution. Each of these types of dispersal has different implications for management of ecological impacts. The appropriateness of each as a means of reducing crowding problems may also be very different from their appropriateness as a means of reducing impact.

Spreading parties out so that they are generally farther apart, but using the same number of recreation sites, will have little positive or negative effect on soils, vegetation, or water (Fig. 2). As long as the number of places being impacted remains constant, the distance between impacted sites is irrelevant. The major negative ecological

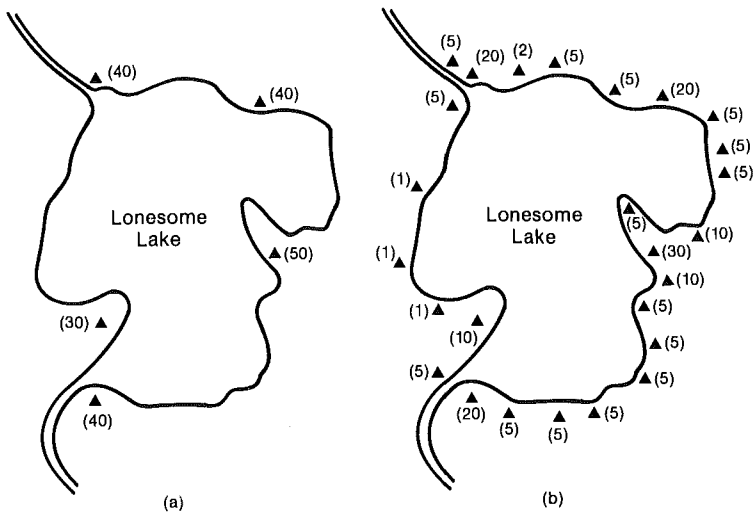


**FIGURE 2.** In (a) use is concentrated in a small part of the recreation area. Each dot represents a camped party. In (b) use dispersal has increased the distance between sites without changing the number of sites. (Source: D. N. Cole.)

impact associated with this type of dispersal is a likely increase in wildlife disturbance. Certain animals (e.g., grizzly bear, elk, bighorn sheep) retreat to parts of a recreation area where contact with people is infrequent. As more of these safe retreats become frequently used, these wildlife species will have less "safe" habitat, and their populations are likely to suffer. The major advantage to this type of use dispersal is to decrease social crowding at places where parties tend to cluster together. Even on the social side, dispersal can have the negative effect of increasing crowding in infrequently used places currently sought out by parties wanting to experience high levels of solitude.

This type of dispersal can be practiced at many scales. Managers can attempt to spread use out over all parts of a recreation area. This is the scale of dispersal most likely to cause problems with wildlife disturbance and loss of high levels of solitude. These two problems are not likely to be severe if use is dispersed on a local level rather than throughout large areas. For example, rather than have numerous sites clustered at one end of a lake, managers might disperse sites around the entire lake. This would reduce crowding, and as long as there was no attempt to disperse use to other lakes or other parts of the area not receiving increased use, it would not negatively impact wildlife or high levels of solitude. In general, then, increasing the distance between parties is a positive action, particularly in large wilderness-type areas, if done on a localized scale. On an areawide scale it has some potentially negative consequences.

When spreading out use entails an increase in the number of sites (and this is probably the most common form of use dispersal), the pros and cons become more complex and difficult to evaluate (Fig. 3). The appropriateness of this type of dispersal depends on amount of use, type of use, user behavior, and resistance of the



**FIGURE 3.** In (a) use at Lonesome Lake is concentrated on 5 campsites. The number in parentheses is the nights per year that the site is used. In (b) the same amount of use has been dispersed over 26 campsites. (Source: D. N. Cole.)

environment. Spreading out use over more sites is most likely to reduce impact in resistant environments, where use levels are low and the type of use and behavior of most users have little potential for inflicting damage. It is likely to be a disaster in popular areas frequented by large parties, horse parties, or parties that know little about low-impact camping, particularly if the area is fragile. Let's explore why this is so.

As is so often the case, these management implications reflect the nature of the relationship between amount of use and amount of impact. The idea behind this type of use dispersal is to reduce use to levels low enough so that impacts are negligible. From the use-impact relationship we know that use levels must be very low before a reduction in amount of use is likely to substantially reduce impact. We also know that to reduce use on one site, use must be increased on other sites. Moreover, increased use of lightly used or unused sites leads to rapid increases in impact.

Let's use a study of lakeside campsites in subalpine forests in the Eagle Cap Wilderness as a case in point (Cole 1982a). This is a relatively fragile environment; growing seasons are short, and the vegetation is easily destroyed by trampling. The study examined the condition of campsites receiving three levels of use. An impact rating based on camp area and impact to trees, ground cover vegetation, and soil was calculated for each site. Unused sites had a rating of 1.0, and the most heavily impacted sites had a rating of 3.0. This can be compared with the mean ratings of 1.6 for low-use sites, used a few times per year; 2.0 for moderate-use sites, used 10 to 20 times per year; and 2.1 for high-use sites, used 25 to 50 times per year.

To evaluate the desirability of dispersing use in this area, let's assume we need to accommodate 4000 parties around these lakes over the 2- to 3-month summer season. The available options would be to have fewer than 100 high-use sites, more than 250 moderate-use sites, or about 2000 low-use sites. Given the great difference in number of sites and relatively small difference in impact rating—even low-use sites are more than one-half as impacted as high-use sites—it seems most reasonable to concentrate use on the 100 high-use sites.

The consequence of attempting to spread use over a large number of campsites in an area with heavy use was documented in the Eagle Cap Wilderness. More than 220 campsites were found in a 325-acre area around two popular lakes (Cole 1982b). Over one-half of these sites had lost more than 25 percent of their vegetation cover, and most were in sight of the trail. Although this still represents disturbance of only 1.3 percent of this popular area, one has the perception that impact is everywhere. Moreover, there is no need for so many sites. The average number of parties using the area is about 10 per night, with use perhaps several times as high on peak-use nights. Management policy at the time of the study was to ask people not to camp on highly impacted sites, that is, to spread out over more sites. By doing the opposite, concentrating use on a few selected sites, disturbance could be confined to perhaps one-fifth of these sites, effectively reducing impact by about 80 percent. Most parties prefer using the more highly impacted sites anyway.

How well would spreading out use over a large number of campsites work in a lightly used area? What if we had to accommodate only 30 parties per year? One option would be to concentrate all that use on one high-use, high-impact site. However,

another option would be to spread this use over 30 or more sites. If more than 30 potential campsites were available, some sites would not have to be used even once per year. We do not have data from the Eagle Cap study to predict the impact associated with just one night of use per year. There are many resistant sites, however, where such low use levels would cause essentially no impact. This is particularly true if the party's potential for inflicting damage is low (e.g., if the party is small, travels on foot, and is knowledgeable about low-impact camping). Therefore, spreading use over more sites makes good sense under conditions of low-use, resistant environments and low-impact users.

The implications of this type of management apply primarily to vegetation and soil impact on trails and campsites, particularly in large areas. Water and wildlife are probably less affected by how frequently individual sites are used. Some animals are highly disturbed only on high-use sites. In Yosemite National Park, for example, problems with black bears are much more pronounced in high-use areas (Key and van Wagtenonk 1983). Bear problems are aggravated by concentrating use on a few sites. However, smaller animals are likely to be more adversely affected by the creation of many moderately impacted sites than a few highly impacted sites. On the social side, this type of dispersal will have no effect on that aspect of crowding related to how frequently recreationists meet other people. It will mean that recreationists see more impacted sites.

Generally, then, dispersal of use among many sites by promoting use of unused or lightly used trails, campsites, or places is likely to substantially increase impact in these places, with little compensatory improvement in the condition of the more popular places, which were the original problems. This type of dispersal typically increases impact proliferation, the primary means by which recreation impacts increase in many areas (Cole 1993). The exception to this generalization occurs in low-use areas where dispersal of use, combined with management of where people camp (on very lightly used, resistant sites) and user behavior, can help maintain low levels of impact.

The third type of dispersal, spreading use over a longer use season, can certainly be beneficial in terms of reducing crowding. However, the ecological effects are, again, complex. Moving use from summer to spring or fall often constitutes moving use to a season when the environment is more fragile. Higher precipitation and snowmelt saturate the soil with water, making it more prone to compaction and erosion. Plants may be more vulnerable in spring when they are initiating growth or in fall when woody plant parts are brittle and easily broken. Wildlife may be vulnerable in spring when they are regaining strength after the winter or in fall when they are getting ready for the winter. Such effects differ greatly from area to area, but they ought to be considered before off-season use is promoted.

In sum, use dispersal is an action that has diverse aspects and implications. It is seldom the panacea that it has sometimes been considered. Even with regard to reducing crowding, it has certain drawbacks. The ecological disadvantages are usually more pronounced. However, there are situations in which dispersal can be useful. The key is to use it at the scale and in the places where it will be beneficial. It is most beneficial when applied to localized areas or in places where use levels are low. Usually

it will have to be supported with programs designed to manage where and how people engage in recreational activities. The effects of the program should also be monitored, because the potential for merely spreading problems around is high.

Where dispersal is desired, it can be accomplished in either a regulatory or a manipulative manner. Regulatory means are comparable to those employed to limit amount of use. Quotas can be established for popular trails, campsites, or zones; when these places are full, additional users must go elsewhere. This technique can be used to increase the distance between parties and/or to avoid concentrated use at certain locations. Of these methods, the highest level of control can be achieved by requiring use of designated dispersed campsites, as is done in the backcountry of Yellowstone National Park. In such a system, visitors must keep to a fixed itinerary, camping at designated campsites, each of which is located a considerable distance from all other sites. In many of the national parks, visitors are required to camp in designated sites. Quotas are set for campsites, but the campsites are clustered in a group. This means that use is locally concentrated but dispersed throughout the park. For reasons previously discussed, this is the worst of both worlds; campsite solitude is lacking, and all parts of the park receive impact. This is often done to make it easier to provide facilities such as toilets.

Spreading use over more sites can be accomplished by establishing use quotas for individual campsites (closing sites to camping after they have been used a certain number of nights) or by requiring that visitors camp on sites that are not highly impacted. One of the few examples of the latter approach is provided by the wilderness management program adopted at Shenandoah National Park, Virginia, in the early 1970s. Groups were required to camp out of sight of any trail or of signs set up in areas where no camping was allowed. They also were to spend no more than two consecutive nights in a single location. Wherever substantial impact started to show, the campsite was posted as a "no camping" area and allowed to recover. This spread use over a large number of sites. An evaluation of campsites in the early 1990s (Williams and Marion 1995) suggested that the dispersal policy had not been very effective in limiting campsite impact. More than 700 campsites were found and one-third of these sites exhibited marked loss of vegetation and soil exposure. Williams and Marion (1995) suggest that a use concentration strategy would be more effective than a dispersal strategy in the more popular locations in the park. They recommend that the dispersal strategy be followed only in portions of the park where use levels are so low that campsites are virtually nonexistent.

Quotas can also be used to spread visitation over time. If no permits are available during popular use seasons, visitors have little alternative but to go during the off-season. Many private parties float the Colorado River through Grand Canyon during the winter months when permits are much easier to obtain than they are during the summer months.

Dispersal can also be accomplished through information and persuasion. This management style is particularly common in Forest Service wilderness areas where freedom and spontaneity are valued highly. Of these, information is preferable to persuasion because it is more subtle and the visitor does not feel pressured to conform, perhaps against his will, to the desires of the manager. Information can be presented





**FIGURE 4.** Personal contact by rangers is a particularly effective means of providing visitors with information. (Photo: R. C. Lucas.)

in brochures, on signs, or through personal contact (Fig. 4). Use redistribution will be most effective if information is provided early in the trip or route-planning process (Roggenbuck 1992). By the time visitors reach the area, it is usually too late to change their minds about where they want to go. This means that written material will usually be the primary informational medium, except in cases where people call and request information.

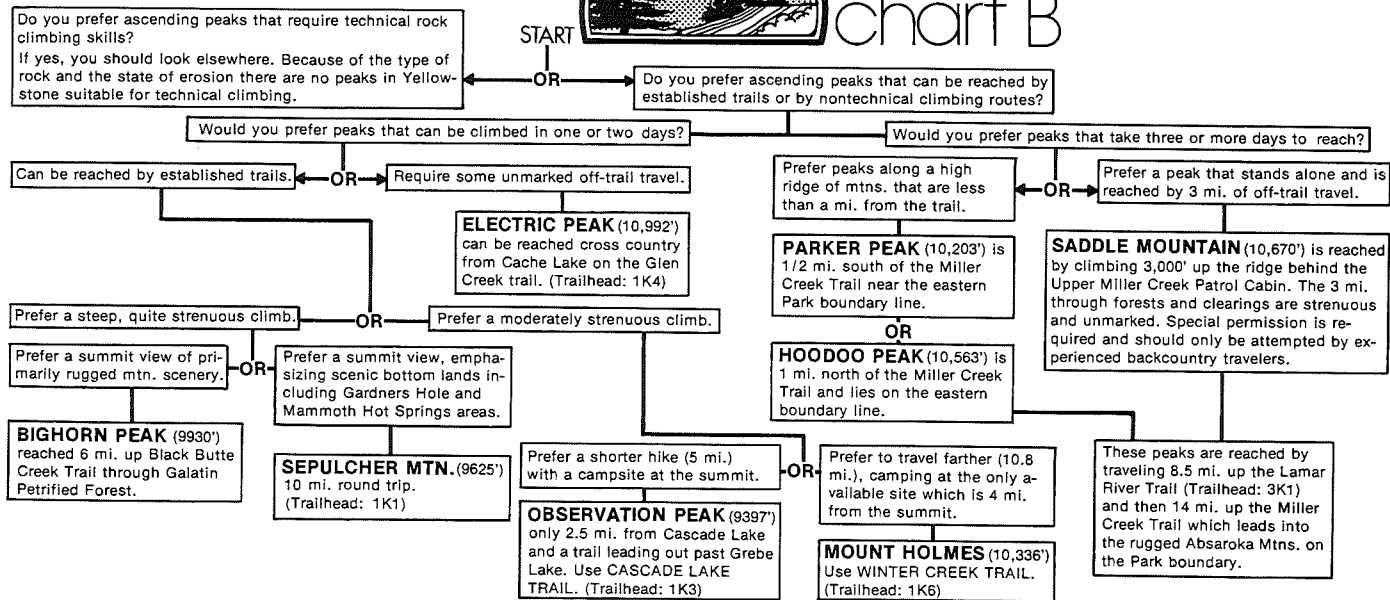
Visitors also appear to want more information than simply the amount of use that different places receive. In several studies, provision of information on amount of use in different places was ineffective in redistributing use (Lucas 1981). Krumpe and Brown (1982) developed an innovative tool that was successful in redistributing use in Yellowstone National Park. They developed a decision tree (Fig. 5) that permitted visitors to match their preferences for different types of trips with the conditions they were likely to encounter on various trails. This technique redistributed 23 percent of all use from more popular areas to these selected trails.

User-friendly microcomputer programs can be particularly effective means of redistributing use. In Rocky Mountain National Park, for example, 60 percent of the backcountry hiking groups that accessed information from a computer about 29 trails selected one of those trails. This can be compared with the 38 percent of groups that selected one of those trails when information was provided in a brochure and just 17 percent of groups that selected one of those trails when no information was provided (Huffman and Williams 1987).

Advertising the attractiveness of winter in the parks has been effective in increasing off-season use of many national parks. In fact, this campaign has been so successful that some parks—like Yellowstone National Park—are now struggling

# Hiking Up Mountain Peaks

chart B

**FIGURE 5.** This portion of the decision tree for selecting trails in Yellowstone National Park illustrates how such a device helps visitors select trips more likely to match their preferences. (Source: Krumpke and Brown 1982. Reprinted with permission.)

to deal with the problems created by heavy winter use. An appeal based entirely on the low use in winter would probably have been less effective. Although providing such information is promising, managers must avoid providing too much information and taking away the sense of discovery and exploration that is important to many recreationists. They must also be cautious about providing only selected information and, of course, should never provide false information.

Signs and personal contact, means of providing information once the visitor enters the area, are most likely to affect local dispersal of use. Utilizing information, for example, Roggenbuck and Berrier (1981) were able to reduce the number of parties that clustered on popular campsites in Shining Rock Gap in Shining Rock Wilderness, North Carolina. The information provided told of the crowded and impacted conditions at the Gap, as well as trail and campsite conditions in some nearby (within 1 mi) alternative camping areas. The number of parties camping at the Gap dropped from 62 per weekend (when no information was provided) to 44 (when information was on a brochure) to 33 (when both a brochure and personal contact with a ranger were used). For experienced hikers the brochure was adequate to redistribute use; for novices personal contact was more effective. Most research suggests that visitors with little previous experience or park knowledge are most likely to be influenced by information. Also, a combination of impersonal messages and personal contact is likely to be more effective than an impersonal message alone (Roggenbuck 1992).

## CONCENTRATION OF USE

Concentrating use is the opposite of use dispersal. As with dispersal, it can operate in a variety of ways. Distances between parties can be reduced without changing the number of sites; use can be concentrated on fewer sites; or use can be more concentrated in time. The first and third of these options may serve to reduce impact on wildlife in certain situations. Generally, however, they entail high costs to visitors, particularly in increased crowding, and are unlikely to substantially reduce impacts. The most common action taken is to concentrate use on as few campsites and as small a proportion of each campsite as possible.

Spatial concentration of use is one of the premier principles of managing developed recreation areas. Spatial concentration can be applied at several scales. For example, campers are usually required to camp on developed campsites rather than in some undisturbed area of their choice. Within the designated campsite, tent pads are commonly provided and campers are encouraged to set up their tents on these pads. Both of these actions are variations on the use concentration strategy. Site management techniques intended to confine use to a small proportion of each campsite will be described in Chapter 13.

As was discussed under dispersal of use, use concentration can be appropriate even in large wilderness areas, particularly in places that are heavily used, where it is likely to be the only means of keeping impact from proliferating widely. Use dispersal can be used to maintain very lightly impacted areas, but in popular places there is little alternative to use concentration. Trail construction is a good example

of use concentration that serves to avoid the creation of numerous user-created trails crisscrossing the landscape. To provide diversity, large portions of wilderness should remain trailless. Where use is consistent, however, trails have to be built, to provide easier access certainly, but also to avoid development of multiple user-created trail systems. Keeping people on trails and preventing them from cutting switchbacks or walking on adjacent braided trails are other examples of concentrating trail use to avoid resource damage.

Concentration of use is particularly important to campsite management. Thornburgh (1986), for example, has monitored campsite impacts in several backcountry areas in the North Cascades of Washington for decades. Over the years many different techniques have been implemented to control impacts. He reports that the only successful approach has been a use concentration strategy—the “Designated Campsite” system.

Concentration can be accomplished either through regulation or persuasion. The regulatory option is to allow camping only on designated sites. The persuasive option is to ask visitors to use only existing sites. Regulation is seldom necessary because most visitors prefer camping on sites that are already well used anyway (Cole 1982b). If education does not work, a regulation can be imposed. If illegal sites continue to develop, the only option may be to reduce use levels.

Once a use concentration strategy is implemented successfully, it may be possible to reduce the number of sites. Certain sites can be closed—preferably those that are poorly located or highly damaged. Once use of these sites is eliminated, they may have to be actively rehabilitated. This will shorten the period that they will need to be identified with “no camping” signs or whatever other technique is used to keep people off. More detail on such site management techniques is provided in the next chapter.

Use concentration becomes increasingly important as the potential for users to inflict damage increases. Therefore, it is a particularly important strategy for managing recreational stock and off-road vehicles. In many places these uses are prohibited on certain trails or in certain areas. In Sequoia and Kings Canyon National Parks, for example, stock are prohibited in places that have never received regular stock use (McClaran 1989). Alternatively, these uses can be allowed only in certain areas established specifically for their use. This is a common strategy for use of off-road vehicles (Fig. 6). In Yellowstone National Park, snowmobiles are allowed only on roads. In the Land Between the Lakes area administered by the Tennessee Valley Authority, off-road vehicle use is prohibited except in the specially designated 2350-acre Turkey Bay Off-Road Vehicle Area, where relatively unrestricted vehicle use is allowed.

## RESTRICTIONS ON TYPE OF USE

Another management option is to separate different types of users or to prohibit particularly destructive users from using parts of the area. Zoning is a common means of accounting for differences in the impact caused by different modes of travel. The most likely actions to be taken are to create zones in which all use, overnight use, or use by parties with stock or motorized vehicles is prohibited (Fig. 7). National forests,



**FIGURE 6.** Concentrated motorcycle use in California has denuded this area of vegetation and eroded the bedrock. (*Photo: D. N. Cole.*)



**FIGURE 7.** Closing areas to certain types of users and uses is a common management action. In the Rattlesnake National Recreation Area, Montana, hiking, horse riding, and bicycling are allowed; motorcycling is prohibited, as are shooting and camping within three miles of the trailhead. (*Photo: D. N. Cole.*)

being divided into wilderness and nonwilderness areas, are already zoned in relation to motor vehicles; all motorized traffic (with a few exceptions) is prohibited in wilderness. Even outside wilderness, motorized vehicles are excluded from some areas for either social or ecological reasons. Prohibitions on motorized use are a common means of reducing wildlife disturbance and deterioration of water quality. Protection of wildlife and of water quality are also the most common justification for excluding either all use or overnight use. Examples include areas that are municipal watersheds and places where encounters with grizzly bears have been a problem.

Excluding stock from certain zones can produce numerous benefits. Hikers who dislike encountering stock are provided with the opportunity of avoiding them if they visit places where stock are prohibited. Selected areas are spared the added impact of stock use, and trail construction and maintenance costs are reduced. In Sequoia and Kings Canyon National Parks, stock use is prohibited in a series of meadows that provide representative examples of pristine meadow ecosystems (McClaran 1989). In Glacier National Park, Montana, stock use is allowed only on certain trails and in certain campsites.

Another option is to not allow certain types of use or behaviors anywhere in the recreation area. For example, stock use is prohibited in almost 40 percent of national park wildernesses (McClaran and Cole 1993). Of those wildernesses that allow stock use, 55 percent require that feed be packed in and 73 percent prohibit tying stock to trees. Other common regulations include prohibitions on campfires, littering, and disturbing vegetation or human artifacts. On white-water rivers, visitors are often required to carry a fire pan (to minimize campfire impacts) and a portable toilet (to pack out human waste).

The important concern with zoning and outright prohibitions of certain uses is that opportunities are not unfairly denied to legitimate users. All areas cannot provide opportunities for all users. Managers should cater to those users most appropriate in their area, basing appropriateness to some extent on regional opportunities for specific uses. For example, a local prohibition on motor vehicles is easier to justify if motorized recreation opportunities are generally available in the region.

## **GROUP SIZE LIMITS**

A limit on maximum group size is a common but controversial restriction on type of use. Common sense and a little research indicates that large groups have the potential to cause more impact than small groups—both on other visitors and on the environment. In a number of studies, visitors indicate that a given number of encounters with large groups is likely to have a more negative effect on their experience than the same number of encounters with small groups. However, if group sizes are reduced, the number of small groups will increase, which will likely increase the number of encounters between groups. Stankey (1973) asked wilderness visitors about this trade-off between encounters and group size, inquiring about their preference for seeing one large group of 30 per day or ten small groups of 3 per day. In three of the four areas he studied, they preferred more encounters with small groups. Moreover,

reducing group size may not have much effect on encounter rates because large groups are so rare. In the Desolation Wilderness in California, for example, only 7 percent of overnight visitors were in groups larger than 6 (Cole, Watson, and Roggenbuck 1995). Breaking a few large groups into small groups would have little effect on the total number of groups. This suggests that the imposition of limits on group size should usually improve social conditions in recreation areas.

Group size can influence amount of ecological impact in two ways. First, if large groups camp as a single unit, they will occupy and impact a larger area than a small group (Fig. 8). In the Bob Marshall Wilderness in Montana, outfitter campsites—which cater to large horsepacker groups—were 10 times larger on average than camps used primarily by private (typically smaller) horsepacker groups (Cole 1983). Second, a large group camping as one unit can impact an undisturbed site more rapidly than a small group, simply because there are more feet to trample soil and vegetation. This consideration is more critical for groups traveling off-trail and in relatively pristine places than for groups traveling through places with plenty of established trails and campsites.

A few studies suggest that certain impacts might increase on a per capita basis as group size decreases. Per capita wood consumption in campfires typically increases as group size decreases (Davilla 1979), and impacts on wildlife from infrequent encounters with large groups may be less severe than more frequent encounters with



**FIGURE 8.** By spreading out over a large area, this large party has created an unusually large area of impact. (Photo: U.S. Forest Service.)

smaller groups. However, the rarity of large groups makes these arguments less compelling. The most significant costs of group size limits are likely to be (1) restrictions on access for the small minority who prefer or need to visit wilderness in larger groups and (2) reductions in the quality of wilderness experiences facilitated within larger groups. Relatively few wilderness visitors would be affected by group size limits as stringent as a maximum group size of 6. However, for those affected, costs would be pronounced. Costs may be particularly severe for commercial outfitters. Opportunities for experiential education and other learning that is dependent on substantial group interaction may also be severely restricted by stringent group size limits. Unfortunately, we know little about the relationship between group size and the benefits that accrue from these experiences.

Most wilderness visitors—about three-quarters of those surveyed in the Desolation Wilderness—support limits on group size (Cole, Watson and Roggenbuck 1995). Moreover, visitors who support limits think those limits should be quite low. More than three-quarters of the supporters of group size limits in the Desolation thought the limit should be no more than 10 people. Similar results have been reported elsewhere. However, managers should interpret this information carefully. The vast majority of wilderness visitors choose to visit wilderness in groups of 2, 3, or 4 people, and they don't like encountering large groups. They typically advocate prohibiting groups that are much larger than their own group. If this action were taken, the majority group would reap all the benefits and pay none of the costs. All costs would accrue to the minority user—the visitor preferring to come in large groups.

Managers are faced with several difficult decisions as they confront the issue of group size limits. Should they listen only to the majority (who have everything to gain and nothing to lose from group size limits), or should they try to provide some restricted opportunities for the minority user too? What should those limits be—6, 10, 20, or 30? And what about limits on groups that choose to bring pack stock as well?

Clearly, there are costs and benefits to group size limits. Benefits are likely to be most pronounced in relatively pristine areas. A single large group traveling off-trail can leave incipient trails and campsites that a small group would not produce. Off-trail hikers are often particularly sensitive to encounters with large groups. This suggests that group size limits are particularly important in more pristine environments. To be effective, however, limits should be quite low, much lower than the common limits of 15 to 25 persons per party in wilderness (Washburne and Cole 1983; Marion, Roggenbuck, and Manning 1993).

Arguments for low limits on group size are less compelling in popular, highly impacted locations. Large impacted campsites are usually available to accommodate fairly big groups. If they are careful, even large groups can use these sites and cause little additional impact. Grand Canyon National Park, for example, has designated a number of special large-group sites in more popular parts of the backcountry. If large groups stay on established trails, there is little concern about creating new impacts.

Differential group size limits may be one means to (1) keep group size limits low enough to be meaningful in more pristine portions of a recreation area and (2) meet



the needs of both majority and minority users. In Yosemite National Park, for example, maximum group size is 25 in trailed areas and 8 off-trail.

A final concern is how to accommodate pack animals in group size limits. If the reason for group size limits is to limit the potential impact of each group, size limits for pack groups should be much lower than for hikers. This follows from the fact that horses cause more impact than hikers (DeLuca, Patterson, Freimund, and Cole in press). Others argue that the regulation should treat stock users and hikers equitably in terms of ease of access and simply limit the number of humans. Therefore, if 15 humans are allowed, those 15 people should be allowed to bring along the 25 pack animals needed to support them if they want to. Both sides of this argument have some merit, suggesting the value of a compromise position. One reasonable compromise, implemented in a few places, is to limit the total number of bodies—human and animal. With a limit of 15, there can be 15 humans, 6 humans and 9 head of stock, or any other combination that adds to 15. Groups with stock will still typically cause more impact than those without stock, but impacts will be less than in situations where there are separate limits for humans and animals.

## LOW IMPACT EDUCATION

Throughout this discussion we have frequently referred to the need to support certain actions with a strong educational program. Low impact education is one of the real keys to reducing impact in all recreation areas, from the most primitive to the most developed. It is not a panacea; it will not solve all problems. However, without educated and caring users, impact management will remain primarily reactionary in nature. Managers will seldom be able to get beyond treating symptoms to deal with the cause of problems. Education is the basic foundation on which to build a complete management program.

In our typology of visitor actions in Chapter 10, we distinguished between illegal, careless, unskilled, and uninformed actions and unavoidable impacts. Education can alleviate impact problems caused by the first four types of action; other steps are needed to control unavoidable impacts. On campsites it should be possible, through education, to virtually eliminate damage to trees and pollution of the site with campfire ashes, food remains, soap, and other waste products. On raft trips through the Grand Canyon, collection of firewood is not permitted (except during the off-season when driftwood can be collected), all fires must be contained in fire pans that protect the ground, and all ashes, garbage, and human waste must be carried out of the Canyon. Even dishwasher is poured through screens into the river, and what does not go through the screen is hauled out. As a result, even beaches that are used almost every night by large parties are not polluted and have little tree damage.

In contrast to some of the avoidable impacts, trampling of vegetation and soil is largely unavoidable. On Grand Canyon beaches, vegetation and soil deterioration is not too serious because most use occurs on barren sand. Trampling does contribute to beach erosion, however (Valentine and Dolan 1979). In less resistant places trampling,

even by low-impact users, can severely alter soil and vegetation conditions. In such places the amount and distribution of use must also be managed.

When developing a low impact educational program, wildland recreation managers need to consider both the *content* of educational messages and the *communication media* they will use to disseminate messages.

### Message Content

Knowledge about appropriate low-impact techniques has developed slowly over the past few decades, with the accumulation of personal experience and recreation ecology research. Until recently, this information has been widely dispersed and not very consistent. In the late 1980s the situation changed with the compilation of research about low-impact techniques (Cole 1989), the publication of *Soft Paths*—the first popular book devoted entirely to low-impact techniques, now in its second edition (Hampton and Cole 1995), and establishment of the national Leave No Trace (LNT) low impact education program. LNT is a partnership between federal land-managing agencies, nonprofit educational organizations, and the recreation industry. Its mission is “to develop a nationally recognized minimum-impact education system to educate federal land managers and the general public through training, publications, video and electronic webs” (Swain 1996).

With the LNT program, consistency in low impact education has emerged. This consistency is most apparent in the following six principles that are the crux of the LNT program:

1. *Plan ahead and prepare.* Take time to learn about the area you plan to visit so you know what to expect. Travel in small groups and take appropriate equipment. On backcountry trips, particularly, repack food so that potential trash is reduced. Finally, if traveling in bear country, be prepared and knowledgeable.

2. *Camp and travel on durable surfaces.* This is a complex principle derived to a great extent from recreation ecology principles covered in this book. In popular areas, concentrate use and impact. Stay on established trails and select a campsite that is already well impacted. Select a site that is large enough to accommodate your group. Set up tents and the “kitchen” in places that have already been disturbed. Leave your site clean and attractive so the next group will want to camp there. In remote, relatively pristine places, disperse use and impact. Spread out while hiking, and select a campsite with no evidence of previous use. Try to select travel routes and campsites that are durable. Disperse tents, activities, and traffic routes when camping in a pristine area and naturalize the site when you leave—so the next group that happens by will not recognize it as a campsite. Finally, stay off lightly impacted trails and campsites. Lightly impacted places are in a state of flux. If they continue to be used, they are likely to deteriorate rapidly and substantially. However, if left alone, they usually can restore themselves.

3. *Pack it in, pack it out.* Pack out litter and waste food. Be particularly careful in bear country.

4. *Properly dispose of what you can't pack out.* Dispose of human waste appropriately, in toilet facilities if they are provided or in cat holes at least 200 feet away from water, trails, and campsites. Pack out toilet paper or, at least, bury it. Do all washing away from camp and never directly in streams, lakes, or springs.

5. *Leave what you find.* Never blaze trees, leave flagging, or build rock cairns along trails. Never make trenches around tent sites or build campsites "improvements." Avoid damaging live trees and plants, and leave natural objects and cultural artifacts.

6. *Minimize use of and impact from fires.* Cook on stoves and minimize the use of campfires. If having a fire in a high-use area, use an existing fire ring. Use only dead and downed wood that can be broken by hand. Burn the fire until only ash or small coals are left. Be sure the fire is out and scatter ashes widely, leaving a clean and attractive fire ring. In remote areas, select a durable fire site. Use a fire pan, build the fire on a mound of mineral soil, or build it in a shallow pit in mineral soil. Do not line the fire with rocks. Naturalize the fire site when you leave.

The LNT program recognizes that educational programs have to be tailored to individual places and user groups. Behavior that may be appropriate in one place may be disastrous in another place. This is most obvious in principle 2, "Camp and travel on durable surfaces." Recommended behaviors in popular areas (where use concentration is appropriate) are precisely the opposite of recommended behaviors in remote areas (where use dispersal is appropriate). More subtle differences also exist. For this reason, the LNT program has developed outdoor skill booklets for seven different ecoregions in the United States, as well as for six specialized recreational activities (river floating, horse use, rock climbing, snow camping, caving, and sea kayaking). Outward Bound and the National Outdoor Leadership School are integrating LNT principles into their international programs, where further modification of the techniques will undoubtedly be required.

### **Effective Communication**

Many different media can and have been used in the effort to persuade recreation visitors to adopt recommended low-impact practices. Douchette and Cole (1993) found that six different educational media were being used in more than one-half of the wilderness areas in the country: brochures, personnel at agency offices, maps, signs, personnel in the backcountry, and displays at trailheads. Some of the less commonly used media were computers and commercial periodicals, radio, and television.

Little has been written specifically about the success of attempts to educate recreation users. However, social psychologists have been studying persuasive communication for years. Roggenbuck and Manfredo (1990) drew on this work to describe three conceptual approaches managers can use to persuade recreation visitors.

The first approach, *applied behavior analysis*, seeks to increase the frequency of desired behavior by providing behavioral prompts, manipulating the environment, rewarding appropriate behavior, or punishing inappropriate behavior. An example of

this approach is to provide incentives, such as discount coupons from an outdoor equipment store, when visitors use appropriate behavior. The need for continuous contacts with visitors—to keep them behaving appropriately—suggests that this approach contributes little to development of an enduring land ethic. It is probably more appropriate in more developed recreational settings.

The second approach is the *central route to persuasion*. With this approach, carefully constructed messages are transmitted to visitors. Visitors receive and process the messages, accept the advice as making good sense, and change their behavior accordingly. These behavioral changes should continue into the future because they result from and are reinforced by beliefs and attitudes the visitors have internalized. Most wildland education efforts take this approach. The challenge of this approach is daunting, however. For such an approach to be successful, visitors must have high motivation, the ability to process information and accept the arguments in messages, and the skills to respond appropriately. That means educators must spend as much time as possible with the visitor and “they must know their audience, tailor messages to meet the audience at their interest and knowledge level, develop interesting, relevant, and well-supported messages, use media which permits self-pacing of message processing (usually the written word), and manage the situation so that distractions are few and the message reaches the recipient on time” (Roggenbuck and Manfredo 1990, p. 106).

The third approach is the *peripheral route to persuasion*. This approach is characterized by little attention to messages and is common in situations of information overload and excessive distraction. Persuasion, if it occurs, is triggered by something other than the message itself. Often the cue comes from the source of the message—the basketball star wearing the shoes you are compelled to run out and buy. This may be the only approach with much chance of success at noisy visitor centers, at trailheads when visitors are anxious to start their trip, or if recreationists are simply not highly motivated to give their attention to messages. Unfortunately, this approach is unlikely to produce long-term behavior change.

This body of theory suggests that low impact education is a difficult task. The value of this work—beyond dashing some illusions about simply going out and telling people what they should do—is that it points out ways to increase the likelihood of success. Managers should use as many of these approaches as they can. They also should learn more about the variables that increase likelihood of success. Roggenbuck and Manfredo (1990) have distilled the findings of social psychologists on five factors that influence success: timing of the message, message content, recipient characteristics, source characteristics, and characteristics of the communication channel.

Timing is critical in attempting to use behavioral prompts, incentives, or peripheral cues. Prompts (such as a Smoky Bear badge) must be closely associated with a desired outcome (such as leaving a clean camp) for the behavior to be learned. Peripheral cues must be provided at decision points, such as when visitors are deciding what trail to take, whether to use a stove, or whether to camp on a lakeshore. It is easy to achieve proper timing for some decisions, but virtually impossible for others. Timing is less important to the central route to persuasion, but the message must reach

visitors in time for them to process and use the information. It is clearly too late to inform visitors about the importance of using stoves when they reach the trailhead.

Message content is important. If managers use the central route to persuasion, the message should provide arguments that are strong, relevant, novel, and simple enough to comprehend. Ending arguments with questions rather than statements can increase the likelihood that recipients will think about the message. Repetition of messages is likely to increase comprehension and acceptance.

Visitor characteristics also influence success. Visitors are more receptive to messages if they (1) think of themselves as being a part of the problem, (2) have relatively low levels of prior knowledge and experience, and (3) are part of small groups. Group leaders are likely to be more receptive than group members, unless they are highly experienced (Roggenbuck and Manfredi 1990).

Characteristics of the educator, or message source, are most important when the peripheral route to persuasion is used or when the visitor is not very well motivated to listen to or think about messages. In these kinds of situations—"learning situations where the recipient is in a hurry, in a distracting environment, is tired, is part of a large group, or is in a situation where the flow of complex information is forced and fast paced (as in some video programs)"—agencies should seek out attractive or well-respected individuals to deliver messages (Roggenbuck and Manfredi 1990).

The final variable is the communication channel. Personnel-based techniques and certain audiovisual techniques are more conducive to peripheral learning than techniques relying on written material. With personnel-based and audiovisual techniques, attention to the message source may be as important as attention to the message itself. Written materials have to be delivered in situations where visitors have the time to process the information. A variety of channels should be used to help ensure that visitors get the message. Because the educational process is so complex, it is important to focus on a few messages rather than try a shotgun approach. For example, Cole, Hammond, and McCool (1997) studied visitor attention to low impact messages posted on a trailside bulletin board and the extent to which visitors gained new knowledge from these messages. They found that visitors' knowledge was increased by exposure to the messages. However, knowledge gain was as great when just two messages were posted as when eight messages were posted. They concluded that in this situation, most visitors were willing to allocate only enough attention to or able to process about two bits of information.

Relatively little research has examined the effectiveness of educational programs in reducing recreation impact problems. The only inappropriate behavior that has been studied extensively is littering. Numerous studies have shown that littering can be reduced with persuasive communication techniques. Successful programs have been based on rewards, punishment, and environmental cues such as trash cans (applied behavior analysis), written appeals about the need to keep places free of litter (central route), and demonstrations in which role models pick up litter (peripheral route) (Roggenbuck 1992). Written messages are often least effective. Punishment-oriented themes are often most effective. At Mt. Rainier National Park, the mere presence of a uniformed ranger was the most effective of various techniques designed to keep visitors on established trails in meadows (Swearingen and Johnson 1995).

The following points should be considered in developing a low impact educational program.

1. *Focus the message.* It is better to deal with a few critical problems and desired behaviors than to overwhelm the visitor with huge quantities of material. It is important to clearly state the problem, the type of behavior that aggravates the problem, and how a change in behavior will improve the situation. If concepts and the rationale behind suggested behavior are clearly laid out, visitors will be better able to vary their behavior appropriately in different situations. It is important that the suggested behavior be reasonable and adequately communicated to visitors. Although personal contact often facilitates initial receptiveness to suggestions, written material may help with retention.

2. *Identify the audience.* By learning about which visitor groups use the area, messages can be tailored to these specific groups. It is particularly worthwhile to identify "problem users," those who contribute most to critical problems. Programs are likely to be most effective if different messages are developed for each user group rather than hitting everyone with the same message. For example, there is no reason to burden backpackers with all of the details of low-impact stock use.

3. *Select communication methods.* Personal contact is often considered to be the most effective means of communication, although brochures can also be effective (Oliver, Roggenbuck, and Watson 1985). Where they exist, visitor centers can be effective places to deliver educational messages. Mass media such as television, radio, and newspapers are other options, but they frequently fail to reach the right audience. Demonstrations and field programs have been used in town, at universities, at club meetings, and at the recreation area. Except in the latter case, these have the advantages of being tailored to a specific group and of providing the information during the planning stages of a trip. This is also true of the low impact information that is increasingly being added to guidebooks and how-to manuals. Managers should seek to contribute to and review material for books written about their area. The most effective programs use a variety of media, each tailored for a particular user group and message.

4. *Decide where to contact the audience.* Again, this depends on the targeted user group and the communication media selected. Some visitors can be contacted at home if they request information or are required to obtain reserved permits. This has worked very well on white-water rivers such as the Colorado River through Grand Canyon. Advance information is critical where required behavior demands special equipment. Local residents—the most frequent users of most recreation areas—can be reached through special programs in the community, on radio and television, or through the newspaper. College students can be reached on campus; horse clubs, Boy Scouts, and other organized groups can be contacted directly.

## SEASONAL LIMITATIONS ON USE

As we discussed in Chapter 8, many environments are particularly fragile during certain seasons of the year. The most common examples are seasons when wildlife are

particularly vulnerable and when soils are water-saturated and prone to disturbance. Thus, it is common for recreational use to be limited during these periods. To prevent wildlife disturbance, critical areas may be closed to all use, overnight use, and use by recreational stock or motor vehicles. Soil disturbance problems are most pronounced when use is by stock or motorized vehicles. Thus, it is common to close roads and prohibit travel with stock before some opening date in the summer when soils have had a chance to dry out. Seasonal stock prohibitions reduce damage to trails and to meadows used for grazing.

Sequoia and Kings Canyon National Parks, for example, have had a long history of pack stock use of meadows. They also have a tradition of studying pack stock impacts and have been in the forefront of attempts to control grazing impacts. One of the techniques they have used is to establish opening dates for pack stock in each drainage of the park (McClaran 1989). Opening dates are set so that the sod in meadows is dry enough to withstand hoof impact before stock use is allowed. Once average opening dates were identified, year-to-year variations were assessed. In dry years, opening dates can be as much as three weeks earlier than in wet years. Snow-pack moisture levels on May 1 are used to determine whether the year is an early, normal, or late year. If opening dates are set in early May, visitors will have enough advance time to plan their trips.

## CAMPFIRE MANAGEMENT ALTERNATIVES

To illustrate the wide variety of techniques usually available for dealing with any specific problem, let us take a look at some alternative campfire management programs. Table 2 presents some alternatives to a policy of last resort in which all campfires are banned (Hammitt 1982). Although there may be situations in which there is no alternative other than the complete prohibition of backcountry campfires, such a policy should be implemented only after considering less restrictive alternatives. The proposed alternatives vary from those that are most *indirect* in controlling user opportunities to experience campfires to those that are most *direct*.

**Information Programs.** The most indirect of the management alternatives is the provision of information to park users about impacts of the campfire and its proper use. Many parks are already using this alternative through interpretive programs and low-impact use brochures. The objective is not to restrict user behavior but to modify it. Information on campfire impacts, low-impact camping, park policies governing the use of campfires and resource preservation, and underused areas where campfire impacts are of less concern may modify user behavior so that campfire impacts are greatly reduced.

**Alternative Fuels.** An action that is closely related to providing general information on campfire impact and use is to encourage the use of alternative fuels. If campers are informed of the advantages of lightweight stoves for cooking, they may choose to use fewer open fires. The use of lightweight lanterns as a substitute for the social campfire might also be encouraged.

**TABLE 2. Alternatives for Managing the Use of Campfires in Backcountry Recreation Areas**

Type of Management	Alternative	Specific Examples
Indirect (Emphasizes modifying user behavior; preserving campfire opportunities)	Information programs	Promote desired campfire policies. Educate users about campfire impacts. Redistribute users to underused areas or more tolerant sites.
	Alternative fuels	Encourage use of lightweight stoves, lanterns, and alternative fuels.
Direct (Emphasizes regulation of user; removal of opportunities)	Elevational zoning	Restrict fires above tree line and in adjacent high elevation plant communities.
	Forest type and site zoning	Restrict fires from forest types that lack fuelwood (e.g., spruce-fir forest).
		Restrict fires from nonforested areas (e.g., grassy balds, beech gaps).
		Restrict fires by specific sites that lack fuelwood or present a fire danger.
	Temporal zoning	Restrict fires to hours of darkness only. (Require stoves for cooking.)
	Seasonal zoning	Restrict fires to winter and cool-weather seasons.
Communal fires	Require several parties to share a common fire.	
Rationing	Ration campfires to $1/2$ or $1/3$ of the nights camped by a party.	
Total ban	Eliminate fires on a parkwide basis.	



**Elevational Zoning.** As a more direct alternative to campfire management, the manager may want to restrict the use of campfires above certain elevations. The small quantities of fuelwood above treeline and in adjacent subalpine plant communities may make it necessary to eliminate the use of campfires in these areas. Because of the short growing season and slow rate of wood production at these elevations, fuelwood production is insufficient to support campfires.

**Forest Type and Site Zoning.** As an extension of the elevational zoning alternative, certain forest types and nonforested areas of a wildland area may have to be zoned as no-fire camping areas. Zones where campfires are prohibited may be those where fuelwood production is insufficient to meet the supply needs of campers. This alternative can also apply to specific sites or locations where use is heavy and fuelwood has been greatly depleted or where forest fire danger is high during the fire season.

**Temporal Zoning.** The philosophy behind temporal zoning is to limit campfires to an esthetic function that occurs only after dark. Many backcountry users are already using lightweight stoves for their cooking. Stoves are more dependable and efficient than campfires for cooking. However, the presence of a stove does not eliminate the desire to have a campfire. Most campers still consider the fire to be an important esthetic and social component of the camping experience. By requiring campers to use stoves for their cooking and to build campfires only after dark, far less fuelwood will be used. Instead of three campfires per day (breakfast, lunch, dinner) or, as sometimes occurs, the all-day cooking fire, the campfire would be limited to a few hours of darkness during the typical summer evening. This action might reduce the demand for fuelwood to the point where the forest could produce enough fuel to meet the needs of campers.

**Seasonal Zoning.** A further restriction on campfire use is to restrict its use to winter and cool season camping. Fuel is needed for heat and comfort during these seasons, but demand is light because of low use at this time of year. This would have the added advantage of encouraging off-season use in places where a shift toward increased off-season use is desirable.

**Communal Fires.** Another means of reducing the number of backcountry campfires and the consumption of fuelwood is to have several parties share the same fire. On South Manitou Island at Great Sleeping Bear National Lakeshore, Michigan, a communal campfire pit is supplied for every 6 to 10 camping sites. Fires are prohibited except in designated pits. The technique appears to be quite successful, with essentially no evidence of tree chopping or removal of horizontal screening vegetation within and between individual campsites. Although this alternative would not serve the needs of all types of campers (i.e., those oriented to solitude), it does provide an opportunity within the spectrum of campfire alternatives for many campers to experience campfires.

The communal fire concept deserves further adaptation to various backcountry areas. Alpine lakes and other destination areas where campers tend to concentrate are likely areas where the communal fire alternative might be tried.



**FIGURE 9.** Extensive campfire impacts, as illustrated in this scene, have led to the banning of campfires in some backcountry recreation areas. (Photo: W. E. Hammitt.)

**Rationing.** Rather than eliminate fires entirely from the camping experience, managers may want to limit fires to only one-third or one-half of each party's camping nights. The rationing of campfires could occur at the time hiking permits are issued, by having campers select the nights they want to have fires. Although difficult to enforce, a potential added benefit of this alternative might be an increase in the quality of campfire experiences. Because it would make sitting around a campfire a less common experience, rationing may cause the camper to place a higher value on the campfire experience when it is permitted.

**Total Ban.** Little explanation of a total ban is needed (Fig. 9). However, much deliberation is needed before resorting to this alternative. Recreation resource management should provide a spectrum of recreational opportunities so that the needs of a diversity of users are met. The campfire is an important component of the camping experience, and we need to provide for its enjoyment when and where possible.

## **VISITOR INFORMATION NEEDED TO MANAGE RECREATION IMPACTS**

To effectively manage visitors, certain types of information are needed. The most obvious is how many people are using the area. It may also be important to know how people are distributed, both in space and over time. User characteristics such as their mode of travel, party size, and length of stay may influence management decisions. Knowing where people come from will help in contacting users for an educational

program. Finally, knowing visitors' attitudes about conditions in the area and their management preferences can also help in development of a management program that is sensitive to the visitor's desires and needs.

As was mentioned before, much of this information can be obtained from permits. Information commonly collected on permits provides data on amount of use, its spatial and temporal distribution, mode of travel, party size, length of stay, and the residence of the person with the permit. Registration is basically the same thing as a permit, except that it is often not mandatory and, therefore, compliance rates are often low (Lucas 1983). Registration rates can be adjusted to compensate for non-registrants, but this requires separate studies of registration behavior. Numbers of people entering an area can be counted with automatic counters. These are sometimes linked to cameras that take low-resolution photographs, which makes it possible to determine method of travel and party size. This is costly, however, and the question of invading privacy can be a concern. Number of people can be observed directly at a sample of times and places, but this is costly too, and the use estimates obtained are not likely to be very accurate. Air photos have been used to count people, particularly those engaged in water-based recreation or at an off-road vehicle area. Of all these options, however, permits are the least costly, most precise, and most informative.

Specialized information on visitor opinions and preferences is more difficult to obtain. The most common method is to use a survey or questionnaire. These need to be carefully constructed and administered in a systematic manner, following established sampling theory. Otherwise, results will be biased and will not provide the information managers are seeking. Surveys conducted or sponsored by federal agencies must be approved by the Office of Management and Budget, a difficult procedure. Other options are direct observation of behavior or use of some sort of diary or self-reporting form in which visitors keep track of certain items of interest to the manager. Observation has been used to determine such things as how much time people actually spend fishing at lakes. Diaries have been used to record information that might be difficult to recall later, such as the high point of a day or the number of fish caught in specific places.

All information is costly to obtain; consequently, it is important to have specific reasons for each bit of information collected. It is almost always better to systematically collect a few types of information than to haphazardly collect many types. Finally, it is important to be sensitive to the visitor. All efforts should be made to avoid unnecessarily inconveniencing or intruding on the visitor. In many cases the visitor is only too happy to provide information, and there are other cases where the information is important enough to demand compliance. Concern for efficiently and sensitively collecting only useful information will avoid most problems and will add considerably to development of a management program.

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