

CARRYING CAPACITY: MAINTAINING OUTDOOR RECREATION QUALITY

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ABSTRACT. A discussion of (1) what is meant by the concept of recreational carrying capacity; (2) what is known about capacities in terms of both how resources and experience of visitors are affected by recreational use; and (3) what alternative procedures the administrator can use to manage both resources and visitors for capacity.

RECREATION resource administrators, planners, researchers, and citizen groups are continually groping for strategies that will tell them how to manage the growing numbers of Americans participating in outdoor recreation activities. We at this symposium are keenly aware of the attractions of outdoor recreation, the rapidly growing needs for recreational services, climbing use figures, hazards to the resource resulting from intensive visitor use, and other barometers of a "crisis in the making."

These topics frequently lead to such questions as What is the appropriate level of use for any given recreation area? What steps can management take to increase an area's capacity without sacrificing quality? At what point must responsible administrators say, "That's enough; we're full; no more can come in"?

THE CARRYING CAPACITY CONCEPT

Few topics in recreation management are discussed as widely or as loudly as carrying capacity. The term is a perfect example of conventional wisdom: everyone talks about managing our recreation resources within their carrying capacity; but when you get to specifics—how many, what kinds, when, for whom, etc.—the discussion bogs down.

We might start with a statement of what carrying capacity *is not*. There seems to be real value in this approach because the term is often used in a misleading fashion. For example, many *space standards* have been popularized, such as those reviewed in *October Recreation Space Standards (Department of the Interior 1967)*. Basically, these standards define the maximum number of use-units (people, vehicles, etc.) that can utilize the available recreational space at

one time for some activity while providing a "satisfactory" experience for the user.

For the most part, there is little evidence to suggest how the "satisfactory experience" factor was arrived at and used in determining various space standards. Also, these space standards have generally failed to incorporate the level of use the physical environment can tolerate over a given time period before serious damage results. Most space standards have developed from intuitive judgments and trial-and-error experiences rather than from quantitative evidence from controlled research.

Recreational carrying capacity is not a simple, single, absolute value. There is no fixed figure we can point to for a particular recreation area and say "This is the carrying capacity." The recreation manager is faced with a complex set of conditions. He must consider a wide range of activities, many of which are in conflict with one another. He must also provide for many different kinds of users; old, young, active, passive, etc. And he must provide opportunities for a wide range of values, many of which are incompatible with one another.

What then *is* recreational carrying capacity? We define it under the assumption that the principal goal of recreation management is to maximize user satisfaction consistent with certain administrative, budgetary, and resource constraints. The recreational carrying capacity is the character of use that can be supported over a specified time by an area developed at a certain level without causing excessive damage to either the physical environment or the experience for the visitor. Thus capacity is a multidimensional and dynamic concept capable of manipulation by the manager consistent with administrative, budgetary, and resource constraints.

There are three basic components of carrying capacity: (1) management objectives, (2) visitor attitudes, and (3) recreational impact on physical resources. These are not independent unique considerations, of course, but are closely interwoven.

Management Objectives

Capacity can be judged only in light of the particular management objectives for a given area. These objectives must define

what type of recreational opportunity or opportunities the area is going to provide. For example, will the goal of the area be to provide camping in a near-natural setting with a low level of development, or will the emphasis be on high-density use with well-developed facilities for both comfort and activities, or what? A person interested in a camping experience in a near-natural setting with few others nearby will not enjoy camping in a state park with many other people camped close by. But this is not evidence that the area is being used beyond capacity. Rather, this individual's desires are inconsistent with the management objectives for this particular area.

At some point it may become evident that management objectives need to be re-evaluated, perhaps changed. With new objectives, management practices may be substantially altered and to the extent they are consistent with the new objectives the manager is on safe ground. Without definite objectives however, trying to manage any location for its carrying capacity will be an exercise in futility.

The goal of maximizing user satisfaction for a given geographic area such as the New England States can be met only if we provide a spectrum of opportunities that meets the diverse and often conflicting tastes of the public.

Burch (1964) has noted that although there is a wide range of recreational tastes, certain kinds of activities tend to be associated with one another. These "activity aggregates" place certain demands on the resource and relate in certain predictable ways to other users. Thus, regionwide planning may be needed to meet the diversity of recreational tastes. However, "no one recreation supplier need feel obliged to meet all demands. Each public agency could aim clearly at a part of the demand, and refer people who want something more, less, or different to a more appropriate area" (Lucas 1963).

Today, developed camping facilities occupy only about 1/20 percent of National Forest land. Although much of the land is unsuited for recreational developments, the notion that we have used up the capacity of our National Forests to provide for recreational demands is simply invalid. We do

face a problem in establishing the appropriate mix of the many kinds of recreational opportunities we might develop, and it is here that an understanding of what the recreationist seeks becomes invaluable to management decision-making. By making sure that a full range of opportunities exists (regardless of the agency or organization that provides them), we will then be in a position to match visitor needs with opportunities rather than trying to develop recreation areas for the mythical "average user" (Shafer 1969).

Visitor Attitudes

"Perception" refers to the process whereby an individual receives information from the social and physical environments in which he operates, interprets it in light of his experience and attitudes, and then reacts. We know that all recreationists do not perceive the environment in the same way; what is a quality recreational experience to one may be entirely undesirable to another.

But perhaps of more importance is that what the recreationist perceives as acceptable or desirable may be quite different from what the manager perceives (Stone and Taves 1958; Lucas 1964; Hendee and Harris 1970). In a study of National Forest campgrounds, Lucas (1970) found that visitors ranked recreational site quality much differently than Forest Service administrators did. Sites ranked by managers as only "fair" were almost all ranked higher by users. Consequently, what the manager judges to be a pleasing recreational environment may be entirely different from what the recreationist seeks.

Defining recreation standards and objectives requires the consideration of *values*. Because values are subjective, to evaluate them is particularly frustrating for managers. Whose values are to count most—the managing agency's or the public's? If public values are to be relied upon, which "public"?—there are so many of them!

The answer to this dilemma is found in how visitor objectives relate to management objectives. As we suggested earlier, the needs and motivations of recreationists vary considerably; so do recreational areas. We must strive to match the two; if we fail to

do so, individual recreation areas will tend to become homogeneous, lacking the variability and diversity needed in a recreational complex. We cannot please everyone everywhere. "It seems misleading to give equal weight to evaluations by people who are seeking a different type of area or experience. By analogy, a Chinese restaurant would do well to ignore the opinion about the food expressed by someone who ate there by mistake while seeking an Italian restaurant" (Lucas 1970).

Although management cannot rely solely on public opinion in formulating decisions, visitor attitudes are valuable in formulating decisions. They help define the spectrum of opportunities needed, and the mix of these opportunities; and they shed light on how visitors might respond to specific management actions. Knowing who may oppose a given management action and taking measures to explain why their preferences cannot be met may be as important as deciding for whom the area will be managed (Lime 1971a). Surveys of public attitudes can give objective, unbiased feedback not otherwise available to the manager on a variety of questions.

Impact on Physical Resources

How much wear and tear of the resources should the manager permit before he says, "that's enough"? This recreational impact on physical resources is the third component of carrying capacity.

Any use of an ecosystem results in some change; Frissel and Duncan (1965) found that only light use of camping sites in the Boundary Waters Canoe Area (BWCA) resulted in a loss of over 80 percent of the ground cover at the campsite. Even in locations where the management objective is to maintain a natural or near-natural setting, we immediately compromise total achievement of that goal simply by allowing use of the location!

Some might argue that the capacity of an area is the amount of use that area can support without serious damage to the resource. But what is "serious" damage? A portion of the damaged site will recover after a brief rest if use is kept low enough to allow the site to recuperate. On the other

hand, certain techniques can be used by the manager to "harden" the site: he can irrigate, fertilize, rotate use, or pave, thereby making the site more resistant to change. But the action the manager takes is based on how change relates to management objectives rather than directly on change itself.

In an activity-oriented, high-density-use campground, the manager would be free to use a variety of techniques to offset problems of resource damage; for example, paving or planting hardy species. However, in a campground where the objective is to provide a camping opportunity in a fairly natural setting, the amount of resource change permissible would be comparatively small. To maintain the natural setting, the manager might have to resort to restrictions on use (numbers of people, kind of use) rather than on techniques that "harden" the site.

What the manager needs to know about recreational impacts upon the resource is (1) the character of change that will occur under specific levels and types of use, and (2) how the predicted change in the physical environment relates to the management objectives for the area. Decisions about how much change is to be accepted will be more viable and defensible if we know more about how people perceive and respond to changes in the physical environment. The final decision will rest with the manager, but he can greatly narrow the range of uncertainty in decision-making through active dialogue with the interested public as well as with planners, engineers, academicians, and researchers.

EFFECTS OF RECREATIONAL USE ON PHYSICAL RESOURCES AND VISITOR ENJOYMENT

As we noted earlier, the management objective set for a recreation area is the controlling factor in determining carrying capacity. In setting management objectives, the physical resources of the area and the attitudes of users must be considered. Both of these variables are affected by increasing loads of recreationists and may together or by themselves establish constraints on the amount of use the area may sustain.

Impact on Physical Resources

We have considerable documentation of the effects of recreational use on soil, vegetation, and other physical components of the resource base. Damage to ground cover occurs not only because of direct bruising and crushing of vegetation, but also because of soil compaction due to trampling by visitors. Root growth is impaired and tree stability is affected. Vegetation sensitive to use may be replaced by more resistant species (*LaPage 1967*). Marked changes occur in hydrologic conditions, such as a reduction in available soil moisture. Substantial amounts of protective plant litter may also be lost, further increasing the chances of soil erosion.

Water is the focus of considerable recreation use. As a consequence, problems of water pollution will represent a growing concern for the recreation manager. Oil and gas pollution from outboard motors is an especially serious problem. Between 10 and 33 percent of outboard fuel is discharged into the cooling-water exhaust stream as unburned wastes—and it may be as high as 40 percent (*Muratori 1968*). Think of the impact of those 7 million outboard craft that were using our inland waters in 1966, over 5 years ago!

Related problems stem from the discharge of human wastes into water bodies, creating not only potential health hazards, but also touching off such problems as algal blooms (*Barton 1969*).

Wildlife plays an important role—sometimes a primary one, sometimes as only an incidental source of enjoyment—in many recreational activities. Regardless of how wildlife meshes into the recreationist's objectives, however, its abundance, behavior, and survival is often influenced by recreational activity.

Impact on Visitor Enjoyment

Only a few studies have been made on how change in site quality affects a visitor's enjoyment or how the amount of recreational use affects the quality of a visitor's experience.

The Outdoor Recreation Resources Review Commission (1962) found that visitors to a wide range of recreational areas were

satisfied with the numbers of other people they encountered. In fact, the study indicated that one out of five persons felt that meeting more people would have been all right. On the other hand, nearly one out of four National Forest visitors in the study felt that use levels were excessive.

One method of reducing the feeling of crowding is to provide a certain minimum spacing between campsites. In a study of New England state parks, Shafer and Burke (1965) found about one out of three persons desired a spacing of 250 to 400 feet (the sites were only 50 to 100 feet apart). In a study of National Forest campers in Minnesota, Lime (1971b) found that nearly all parties preferred to be well separated and screened from their neighbors. On the other hand, many recreationists prefer and even seek areas that afford opportunities to be close to others (Burch and Wenger 1967).

The most substantive work on crowding has been conducted in wilderness. In the Boundary Waters Canoe Area, Lucas (1964) found that canoeists objected to encountering others more than motorboaters and motorcanoeists did. Canoeists defined crowding not only in terms of numbers of people, but also in types of use (motorboats). On lakes where total season use was less than 300 groups of canoeists, canoeists felt that crowding was no problem. Where motorboats were found, however, canoeists felt crowded sooner. In another study in the BWCA as well as in three western wildernesses, Stankey (1971) found that tolerance to crowding was a function not only of the level and type of use encountered, but also of where and when the encounters took place and the destructive behavior of visitors.

Thus unrestricted recreational use will eventually lead to soil compaction, alteration in plant species composition, increased erosion, and dissatisfaction among visitors—regardless of whether we are talking about a state park campground or a wilderness area. Since these areas have different objectives, the decisions a manager might make and the alternatives he may wish to consider are different.

TECHNIQUES FOR MANAGING THE PHYSICAL RESOURCES AND VISITORS FOR CARRYING CAPACITY

All too often we view carrying capacity in an "either/or" context: either we allow use to continue unchecked or we drastically restrict numbers. Although both of these actions are alternatives that the manager may at some time decide to adopt, there is a wide variety of alternatives and techniques available to management that will help insure the goal of maximizing user satisfaction while protecting desirable resource characteristics before it becomes necessary to actually restrict numbers. We must re-emphasize that the option or combinations of options a manager may consider for any area depends primarily on the management objectives prescribed for that area. The specific goals of the area limit the character of options the manager can use.

The manager should try to accomplish the following—much of it based on Wagar's (1964) discussion of managing for carrying capacity—depending on the area and its management objectives: reduce conflicts among competitive uses; reduce the destructiveness of people; increase the durability of the physical resource; and provide increased opportunities for visitor enjoyment. These goals can be achieved by three overlapping courses of action: (1) site management; (2) modification of visitor behavior through direct regulation; and (3) modification of visitor behavior by means of indirect and more subtle measures.

Site Management

Imaginative site design, landscaping, and engineering can effectively increase the carrying capacity of some sites by channeling the movements of visitors, thereby limiting the area they damage, providing surfaces that withstand intensive use, and providing access to areas that are otherwise unused or very lightly used.

The movements of recreationists often can be guided by the design and arrangement of facilities and barriers. Posts, logs, rocks, and, in more critical places, fences or guard rails, can be used to keep vehicles in parking spots and out of campsite and pic-

nic areas (Magill 1970). Paths, elevated walkways, and bridges can similarly channel movement.

Care should be exercised in selecting the route of paths. Routes that are picked simply because they happen to be the cheapest or easiest place to put a path probably will do little to enhance visitor satisfaction. On the other hand, letting visitors choose their own routes around the campground and then hardening these paths could result in an unnecessarily large amount of ground being paved. We need more information about the factors that influence pedestrian traffic flow.

Several techniques can be used to increase the durability of the biotic community. Sites that have been damaged by overuse will eventually recover, given enough time. The demand for recreational space is such, however, that most managers cannot afford to have a substantial proportion of the areas under their administration tied up in natural restoration. As a consequence, managers will generally need to assist natural recovery processes.

Irrigation, fertilization, and reseedling can greatly accelerate the recovery of sites. Herrington and Beardsley (1970) found that an application of water, fertilizer, and seed would revegetate 70 percent of the cover at campgrounds in central Idaho in only 3 years, a percentage unattainable through the application of seed alone.

Where recreation use is heavy, managers may wish to convert the natural vegetative cover to more hardy species. Ripley (1962) has listed a number of conifers and hardwoods that demonstrate considerable resiliency in the face of heavy recreation use. Thinning the overstory also can increase the resistance of trees and understory vegetation to abuse (Wagar 1965). Judicious thinning could be done to protect soil-moisture values while not appreciably reducing the amount of shading for visitors.

Recreational use can be redistributed and capacity can be increased by providing access to previously underused areas. This means not only additional roads and trails, but also construction of facilities. The installation of trails, lights, elevators, etc. at some of the Nation's more spectacular cav-

erns (Carlsbad, for example) has unquestionably disturbed the cave's ecosystems. Few of us, however, would enjoy these areas had they not been altered to increase their carrying capacity. It is important to recognize that providing access not only effectively increases capacity; it can also quickly alter the type of recreational opportunity offered.

Regulating Visitor Behavior

Through direct regulation of where visitors may go, how long they may stay, and when they may enter the area, management can attain a desired intensity of use for a particular site. Regulatory procedures include zoning, rotating use, limits on party size, and reservations. Implicit in these techniques is a trade-off between the loss in the recreationist's freedom of choice and the gain in ability of the site to more nearly meet the visitors' needs and objectives.

More visitors competing for the same amount of recreational space will frequently mean that they interfere with each other's activities. For example, water-skiing and fishing in the same area just do not go together. Mechanized trail travel (snowmobiles, trail bikes, ATV's) is largely incompatible with foot travel. Allowing high-intensity bike use in the immediate vicinity of an important nesting area for eagles could create a serious conflict.

Separating or zoning conflicting uses accentuates the need for careful and deliberate planning, but the benefits to be gained will generally outweigh the costs. Perhaps most important, zoning can assure the perpetuation of a range of recreational opportunities in an area. It assures the user's right to a free choice among alternative forms of recreation. In winter setting aside separate trails for snowmobilers and snowshoers or cross-country skiers seems especially warranted if management wants to maximize enjoyment for both groups. In the Boundary Waters Canoe Area, outboard motors and snowmobiles are banned from about one-half of the total area to reserve this part of the region for more primitive forms of recreation and travel.

In Alaska, the State Fish and Game Association has instituted a zoning plan in

controlled-use hunting areas that will restrict use to primitive travel (foot, dog team, or horse) in some areas while only foot travel would be permitted in other areas. Also planned is time zoning where only so many people are permitted in a certain area at a time.

Rotating use among available sites and relying on the inherent resiliency of the resource to accommodate use is another means for reducing permanent damage caused by concentrated use. Temporary recuperation periods after watering, seeding, and fertilizing probably would be most desirable. Developed recreation areas could be designed in such a way that sites are rested 1 year in 3. In camping areas and picnic grounds, for example, this could be accomplished by constructing three distinct areas with separate access roads and closing off a different one each year. This would require that areas be overdeveloped by at least one-third; but, coupled with a continuing maintenance program, the results might be very rewarding.

Limiting the size of parties is an important management tool for alleviating damage to the resource. Large groups are excessively destructive of resources not only because of the large amount of space they require but also because of the intensive nature of the use. For example, ten separate parties of three horses each who use an area over a 2-month period undoubtedly will have a less detrimental impact on the trail and campsites than if all 30 horses traveled as a single group.

The noise and congestion often associated with large groups is another reason to limit party size. Although we as yet do not know how visitors react to large groups in developed recreation areas, Stankey's (1971) research in wilderness showed that large parties are strongly disliked by others. Even though large groups constitute only a small proportion of total use for most recreation activities, they may well cause a disproportionate loss of enjoyment.

Requiring recreationists to obtain reservations is one way to control both the level and character of use at any given area. Complete switchover to a reservation sys-

tem might create some formidable administrative problems as well as negative reactions on the part of some of the recreating public. A limited reservation system may be very useful, however.

For example, the State of Oregon has put some of its large state parks on a reservation system for the summer use period. A central clearinghouse with a toll-free telephone number maintains information regarding available camping locations. Reservations are made by phone or mail with each individual park. Although difficulties have been encountered with the program (people not showing up for their reservations, for example), the system seems well accepted. One result of the reservation program has been a shift in the makeup of use at different camps; Oregon residents tend to use the reservation parks more, while nonresidents fill the nonreservation camps.

Modifying Visitor Behavior

By understanding the factors recreationists consider in making decisions about where to go, and what to do, managers can modify visitor behavior in more subtle and less obtrusive ways. By doing so, the manager does not interfere directly with the visitor's freedom of choice, yet he influences the user to make choices that produce desired changes. Visitor behavior can be modified by (1) communication and interpretation services, and by (2) fees or other eligibility requirements. Techniques to maintain the site also fall in this category because the way in which facilities are managed can influence a user's decision on whether to visit the site or not and how long to stay.

It is our opinion that the dissemination of information to the public is one of the most fruitful tools administrators have available to modify visitor behavior. By increasing contact with the public (both visitors and potential visitors) managers can probably solve many current problems and help avoid others.

Communication and interpretative services for recreationists are many and varied. Organized services with personal contact

include illustrated talks, movies, slides, nature walks, tours, and campfire programs. Other services include self-guiding trails and roads, museums, brochures, maps, and guidebooks. Communication between one public agency and recreationists could be increased by greater dissemination of information through other public agencies, local businessmen and chambers of commerce, newspapers and magazines, and radio and television.

Another approach is to build some visitor information centers in metropolitan areas so users can more efficiently plan trips in advance. This also would provide an opportunity to educate them about appropriate behavior, rules, etc. Because many users find recreation areas by just driving around, it is essential to have an adequate number of effectively placed roadside information signs. A study in Utah showed recreational use of an area could be changed substantially by signing (*Brown and Hunt 1969*). Finally, there undoubtedly are countless imaginative communication techniques being utilized in other fields of public relations that can be applied directly or modified for use in recreation management.

What are the byproducts both for managers and recreationists of an effective communication or interpretation program? First, increasing our contact with visitors can help them find out what the range of recreation opportunities and attractions is in a given geographic area. They can then route themselves to those areas that match their interests. Recreational experiences may also be enhanced if visitors can be taught an understanding of basic concepts of ecology and other outdoor values. This in turn should increase their awareness of some of the more subtle attributes of an area (geology, wildlife, vegetation, archeology, and anthropology). By deepening their sense of appreciation and awareness for the natural environment, more recreationists could take better advantage of an area's recreation potential.

Second, we hope that increasing the flow of educational information to the public will result in a reduction in the destructive behavior of some persons. We assume here that much of their destructive behavior is

simply the result of not knowing what is right, rather than overt maliciousness.

Third, better communication with the public gives the manager an opportunity to explain to those visitors who object or are opposed to certain management actions why their preferences cannot be met. Not only should management try to better understand the needs of their clientele, but they have an obligation to help the public understand the needs and goals of recreation management. Ultimately, this two-way process can do much to win public acceptance and support of many management procedures.

Finally, increasing the flow of information that the recreationists use in making decisions is another way to change patterns of use. More uniform and efficient use among sites should be possible. For example, people seeking solitude should be informed where use is lightest. This would both make use of sites more uniform and would also help people to maximize their enjoyment. Snowshoers and skiers would probably appreciate very much knowing on which trails they could least expect to encounter snowmobiles.

Various aspects of visitor behavior—especially use patterns—can also be modified in both space and time by the use of entrance fees, particularly differential fees. Where there is wide variation in the intensity of use between similar recreation sites (campgrounds, trails, etc.) in a given area, differential fees could produce a more even distribution of use. In much the same way that airlines and hotels use off-season rates to attract tourists, both public and private recreation suppliers could employ differential charges to shift some use to off-peak times (*LaPage 1968*). Managers of camping areas, for example, could lower or perhaps eliminate entrance fees altogether when use is traditionally low—on weekdays, during Indian summer, and so on. Some managers will be in a position to promote winter camping and extend special rates in an effort to spread use to other seasons. For those recreationists seeking an escape from the normally crowded summer campgrounds, these opportunities could be especially appealing.

Requiring recreationists to demonstrate a certain minimum level of knowledge or skill before they are eligible to participate in an activity or enter an area is another means of maintaining recreational quality where there is limited capacity and high demand. The "hunter safety" program is similar to what we have in mind; young people are required to show a certain level of proficiency in firearm safety and game-management principles before receiving a hunting license. Because of potential crowding in wilderness, "entrance exams" may some day be desirable to maintain the quality of such areas (*Hardin 1969*). While these actions of management are regulatory to a point, they do not interfere directly with the recreationists' freedom of choice. Once he has demonstrated his ability, a person is essentially free to do as he pleases, consistent with certain rules of safety.

Eligibility requirements could also be established differentially to shift use from one place to another and from one time period to another. Inexperienced canoeists, for example, might be excluded from certain streams at certain times until they reach an acceptable level of proficiency. Snow skiing is another activity where an individual could be required to demonstrate a minimum level of skill before he could use certain slopes.

We hasten to add that law enforcement also has its place in managing for capacity. Regardless of what the land manager does to protect the resource and enhance visitor enjoyment, some people simply will not get the message. To protect the site as well as the rights of the careful visitor, the responsible administrator may at times have to rely upon legal sanctions.

SUMMARY AND CONCLUSIONS

Our efforts to explore the topic of carrying capacity have left us with five conclusions.

1. There are many possible carrying capacities for a given recreation area. These capacities can be defined only in light of the objectives for the area in question. These management objectives must consider: (1) the type of recreational oppor-

tunities the area itself is going to provide, and (2) the recreational opportunities other recreation suppliers in the immediate area provide. As a result, managing agencies should work closely with each other in regional planning so their individual areas function as part of a whole.

Providing a wide range of opportunities to choose from in a region will help visitors maximize their enjoyment. Use patterns should more closely parallel the goals of management, and the efficiency of management should be more nearly optimized.

2. Determining carrying capacity ultimately requires the consideration of human values. Because of the subjectivity of these values, it is essential that managers carry on an active dialogue with a variety of publics. In this way management objectives and capacity guidelines will be more viable and defensible against public criticism.

3. The resistance of an area's resources to use is an important constraint on carrying capacity. Yet, knowing how the resource is affected by various levels and types of use does not by itself tell the manager what is an acceptable amount of change to permit. There are many possible standards of acceptable change that the manager could employ. It is important to remember that the objectives for the area are the controlling factor for these standards. Managers must consider the opinions and concepts of a variety of publics before they act. Although administrators cannot manage by public opinion alone, these opinions can help the manager narrow the range of uncertainty in the decisions he makes.

4. There has been considerable research about the effects of recreational use on resources and recreationists. Our knowledge of the adverse effects of use on soil and vegetation resources is relatively good; knowledge about the effects on other resources—especially water and wildlife—is much less definitive.

Our knowledge of how various levels of use, types of use, and site design affect the experiences of users is still less understood. We have learned, however, that recreationists who appear superficially similar do not

have identical needs and do not perceive the recreation environment in the same manner. Nor do managers perceive the recreation environment in the same way as recreationists. Because of differences in people's tastes, it is essential that leisure behavior be thoroughly understood.

5. Managing an area for its carrying capacity can be accomplished in many ways. Numerous procedures are available to the manager before it is necessary to ration total numbers of recreationists. The aim of these techniques should be to: reduce conflicts among competing uses; reduce destructive behavior of people; increase the durability of sites; and provide increased opportunities for visitor enjoyment.

Procedures for postponing the rationing of use include: (1) site management—barriers, paths and trails, roads, artificial surfaces, irrigation, fertilization, and hardy species of vegetation; (2) regulating visitor behavior—zoning, rotating use, party size limitations, and reservations; and (3) modifying visitor behavior—communication and

interpretation services, fees (especially differential fees), and other eligibility requirements. The *best* technique or combination of techniques to use depends primarily on the particular recreational opportunity the area is meant to provide.

Regulations, direct or indirect, are useful tools for the recreation manager. But they must be applied thoughtfully, with careful reasoning underlying their implementation. A campground filled with signs saying what a person *cannot* do will not go very far toward meeting the underlying objective of recreation management—maximizing user satisfaction. Regulations should be viewed as means to an end rather than as an end in themselves. All of us, administrators, managers, researchers, and the recreating public, need to remember that. To the extent that a regulation helps meet management objectives, it is useful. Beyond that, it is simply an encumbrance to all parties concerned. More important, indefensible regulations will make it more difficult to institute needed rules at some later time.

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An extensive bibliography relevant to carrying capacity decision-making is available upon request to the authors.