Maintaining the Quality of Park Resources and Visitor Experiences

A Handbook for Managers

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Preface

Park and recreation professionals are increasingly challenged to meet a dual, and seemingly conflicting mission—to protect and sustain natural and cultural resources for future generations as well as to provide high quality and enjoyable experiences for people. Many resource areas, both public and private, are threatened by numerous visitor-caused impacts. For some managers the situation is reaching crisis proportions. The biophysical environment is being damaged beyond acceptable limits and the people visiting these areas are no longer attaining the quality experiences and benefits they seek.

Managers, planners, and researchers have long wrestled with ways to effectively address unacceptable visitor-caused impacts, such as crowding and congestion, visitor conflicts, trail and campsite deterioration, impacts to vegetation and wildlife, and noncompliant visitor behavior in recreational settings. A large body of research exists to support decisions to eliminate or reduce these unacceptable impacts. What is needed is a synthesis of the information relevant to decisionmaking and a "hands-on" process to help managers apply the information.

The purpose of this handbook is twofold: (1) to provide resource managers with a step-by-step, easy to use process for identifying and defining unacceptable impacts to biological and cultural resources and to visitor experiences, and (2) to identify a range of strategies and tactics managers can use to address unacceptable impacts to resources and experiences.

The handbook was commissioned by the National Park Service (Denver Service Center) as a complement to its Visitor Experience and Resource Protection (VERP) framework, which was developed to address carrying capacity questions concerning visitor-caused resource impacts and impacts to the quality of visitor experiences (USDI, NPS 1997a,b). Although the handbook can be used by managers who have implemented VERP or other planning frameworks, such as Limits of Acceptable Change (LAC) and Visitor Impact Management (VIM), it also can be used by managers where such frameworks have not been applied or used to address visitor-caused problems.

The introduction section of the handbook briefly outlines the decision process managers use to address visitor-cased problems. The process involves identifying and prioritizing problems, identifying strategies and tactics to address unacceptable impacts, selecting appropriate tactics for implementation, and evaluating and implementing tactics to determine if desired results are achieved.

Part one describes a five-step decision process in which both the tasks of accomplishing each step are described as well as the resources or inputs necessary for carrying out the tasks. A critical part of this discussion is describing the three worksheets used in the decision process addressing unacceptable impacts.

Part two includes copies of the three worksheets and outlines how to use them in addressing real-world problems. The worksheets and decision process can be used in a group setting in which several individuals brainstorm and discuss options. Or, individuals can use the worksheets themselves to plan problem-solving activities.

Part three serves as a reference or source book for analyzing and selecting tactics and actions to ameliorate impacts. Twenty-five tactics are described and evaluated. A standard format is followed so managers can compare options.

This handbook builds on previous research and management experience during the past three decades to identify and describe alternative management techniques to address visitor-caused impacts. Our effort has built heavily on the publications by Cole, Petersen, and Lucas (1987), *Managing wilderness recreation use: Common problems and potential solutions*; and Cole (1989b), *Low-impact recreational practices for wilderness and backcountry*. While our work has expanded the management topic beyond wilderness to include all types of recreation settings and areas, we think our major contribution may be providing a process in which analysts use worksheets to specify their most critical problems and identify alternative management tactics to address the problems. The worksheets give users a visual process for evaluating and prioritizing among those tactics selected during the brainstorming.

The handbook was field-tested in early 1997 in four National Park Service units (Arches, Mesa Verde, Grand Teton, and Yellowstone national parks). In addition to Park Service employees, representatives from at least one conservation organization as well as managers from the Bureau of Land Management, USDA Forest Service, and several state resource management agencies evaluated the handbook. The authors and two employees from the Denver Service Center conducted two- to three-day workshops in which attendees used the handbook to address real problems at their site. The attendees also reviewed the content of the handbook for clarity and ease of using it in a field situation. Significant changes in the handbook followed the pilot-test activities.

We gratefully acknowledge the many individuals that aided in the development, evaluation, and publication of this handbook. A special thanks goes to the approximately 40 individuals that participated in the field tests. We especially thank the Denver Service Center employees (Mary McVeigh and Amy Schneckenberger, now at Yosemite National Park) who collaborated with us in conducting the field tests. We further acknowledge several people that provided technical review of the entire handbook and/or offered specific input to the organization and content of this publication. From the National Park Service: John Austin, Jan Harris, John Hoesterey, Marilyn Hof, Joel Kussman (retired), Rich Lichtkoppler, Mo Miller, Grant Petersen, Noel Poe, Michael Rees, and Gail Slemmer. From the Bureau of Land Management: Chris Barns and Russ von Koch. From the USDA Forest Service: David Cole. From universities: Robert Manning (University of Vermont), Stephen McCool (University of Montana), and Gail Vander Stoep (Michigan State University). Marilyn Hof and Gail Slemmer were especially helpful in preparing and editing later drafts of the handbook. Of course, the authors remain responsible for the final content and production of this handbook.

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Introduction

Using the Handbook

This introduction answers three questions:

- What is the handbook?
- What can and cannot the handbook do?
- Who should use the handbook?

What is the Handbook?

The handbook is a resource for public land managers who have identified unacceptable impacts to resources and visitor experiences and want to act to eliminate them. In this handbook, only visitor-caused impacts are addressed. Specifically, the handbook assists managers in:

- Identifying strategies for addressing unacceptable visitor-caused impacts, and
- Selecting appropriate management tactics for managing unacceptable visitor-caused impacts.

The handbook is divided into three parts. Part one outlines a decision process that helps managers analyze problems related to visitor use and options for solving them. Part two provides three *worksheets* to implement the decision process. Each worksheet is designed to aid managers at various stages in the decision process. Part three describes 25 different management *tactics* that can be used to address unacceptable impacts to resources and visitor experiences. The tactics are organized into five different categories. Each category contains tactics that are similar in some way to the other tactics in that category.

Part One—Decision Process

The decision process consists of five separate but interrelated stages: (1) problem awareness, (2) problem specification, (3) strategy and tactic selection, (4) plan implementation, and (5) monitoring. For each stage of the decision process, resources are suggested that may help in completing that stage. Appropriate worksheets are noted and provided in the handbook for the problem specification, strategy and tactic selection, and plan implementation stages.

Working through the decision process, problems are recognized and defined as one or more visitor-caused *unacceptable impacts*. Unacceptable impacts can include degradation of biophysical resources, cultural resources, or human (visitor) experiences. Most problems involve a combination of such impacts. Managers address unacceptable impacts by selecting appropriate *strategies*. For each strategy selected, appropriate *tactics* are chosen.

Based on the tactics chosen, managers identify and implement specific management actions. For example, a problem might be overcrowding on a particular hiking trail. An unacceptable impact might be seeing more than 50 people per day on the trail. A strategy might be to reduce use in the problem area or management zone. A tactic related to this strategy might be to provide visitors with better information about trail opportunities and when and where various levels and types of visitor use can be expected. A specific management action appropriate for this tactic might be to publish a trail map with accompanying text concerning use patterns. Another tactic related to this strategy might be to control visitor access to the overcrowded trail. A specific management action for this tactic might be to limit use on the trail by requiring all trail users to obtain a permit for hiking on the trail and limiting the number of available permits.

Part Two—Worksheets

Part two of the handbook describes and illustrates the three worksheets associated with the decision process. The first worksheet is used once the manager enters the decision process's second stage—problem specification. Worksheet 1 provides a place for the manager to explicitly state the problem. Once stated the manager is then asked to specify the types of resource and visitor experience impacts associated with the problem. Then, for each impact, the manager is asked to state what the acceptable resource condition would be and what the existing impact is. Based on this information, the manager then indicates whether the existing impact is acceptable, unacceptable or approaching unacceptable levels. If the impact is unacceptable or approaching unacceptable levels, then the manager describes the possible causes of the impact.

Once the problem specification stage of the process and worksheet 1 are completed, the manager is ready to begin the strategy and tactic selection stage of the process. In this stage the manager decides an appropriate strategy (or strategies) and relevant tactics to resolve the unacceptable impact. Worksheet 2 provides a list of strategies and appropriate tactics. The manager writes the unacceptable impact to be addressed at the top of worksheet 2 and then selects which strategies and tactics could be used to solve the problem. Space is provided to record comments related to the appropriateness and implications for each strategy and tactic selected. Following a review and analysis of the various strategies and tactics, the manager selects the tactic(s) to implement.

When the strategy and tactic stage and worksheet 2 have been completed, the manager moves to the plan implementation stage of the decision process. In this stage, tactics, which were evaluated and selected in stage three and which can be implemented, are listed on worksheet 3. For each

tactic listed on worksheet 3, the manager develops a work plan listing specific actions to be implemented, who is responsible for implementing the action(s), and the time frame in which it is to be implemented.

Part Three—Management Tactics

Part three of the handbook describes 25 tactics useful in resolving unacceptable impacts. It is intended to be a reference or source book to help guide managers in comparing, evaluating, and selecting courses of action to eliminate unacceptable impacts. The handbook is divided into five sections: (1) site management, (2) rationing and allocation, (3) regulations, (4) deterrence and enforcement, and (5) visitor education. Each section represents a specific category of management tactics. Each category represents a distinct approach to resolving unacceptable impacts to resources and visitor experiences. Within each category are several tactics that might be used to resolve a particular impact. Tactics within each category vary in terms of how restrictive and appropriate each is for a particular impact.

At the beginning of each section is a general overview and description of the tactic category. Following the general description is a list of tactics found in that section. The write-up for each tactic includes a statement of its purpose, description, costs to visitors, costs to managers, and effectiveness. In many cases, specific management actions, related to a tactic, are also given. Selected references also are given for each tactic for those who want more information about it.

What Can and Cannot the Handbook Do?

The handbook stimulates the informed consideration of a range of options to address unacceptable use-related impacts to resources and visitor experiences. It does this by stimulating critical thinking and in-depth discussion of a range of strategies and tactics. The handbook provides information that can help managers assess strategies and tactics in light of both general and site-specific factors.

The handbook cannot, however, produce a single right answer. Selecting appropriate management tools is a value judgment. Ultimately, managers are left with the difficult decisions of how much use is appropriate, what kinds of activities are acceptable, and how visitor use is to be managed. Using the handbook helps managers reduce the range of uncertainty associated with balancing scientific, legal, budgetary, administrative, and political factors.

The handbook can

- Address problems related to the impacts of visitor use on the resource and visitor experiences
- Provide supporting rationale for informed, defensible decisions
- Provide an analytical process for selecting appropriate management actions

The handbook cannot

- Provide a quick, easy solution to management problems related to visitor use
- Solve problems unrelated to visitor use
- Guarantee 100 percent scientific accuracy or eliminate the need for good judgment by resource professionals

Who Should Use the Handbook?

The handbook was developed for use by National Park Service (NPS) managers. Nevertheless, it can be used effectively by any federal, state, county or local public land manager responsible for managing recreational use and resources.

Although the handbook was envisioned to be used by managers in a group decisionmaking setting where people would brainstorm, discuss options, and make decisions, it can be used in nongroup settings. For example, a group decisionmaking meeting would probably be appropriate if area managers were witnessing rapid increases in numbers of visitors on several popular trails and there was a parallel increase in the number of social trails near these popular trails. In this case, the nature of the problem is related to several impacts and several areas throughout the park. Each of these areas may be managed for a different set of visitor experiences. Therefore, the solution to the problem and its impacts on resource and visitor experiences may differ from one area to the next and would probably include more than one staff member's area of responsibility. On the other hand, a group decisionmaking setting may not be appropriate or needed for a problem such as increased amounts of litter in an auto-access campground. In this case, the manager responsible for maintenance of the campground could use the handbook to select an appropriate strategy and related tactics to resolve the problem.

Part One

Understanding the Decision Process

The decision process for managing social and biophysical impacts of recreation use consists of five major stages: (1) problem awareness, (2) problem specification, (3) strategy and tactic selection, (4) plan implementation, and (5) monitoring (figure 1). This handbook provides worksheets and a detailed description and discussion of the problem specification and strategy and tactic selection stages of the decision process. A worksheet is provided and described for the plan implementation stage of the process. This handbook does not provide guidance on carrying out the problem awareness or monitoring stages of the decision process. The authors assume managers who use the handbook are aware they have a resource or visitor experience problem attributed to recreation use. Monitoring the effectiveness of management actions to resolve recreation use impacts (stage 5) is beyond the scope of this handbook.

Problem Awareness

Problem awareness is the first stage in the decision process. Problem awareness means that managers recognize that a condition exists that results in unacceptable impacts to the resource and/or visitor experience. It also means that managers realize these unacceptable impacts must be addressed. Managers may become aware of unacceptable impacts in a variety of ways. They may discover them through their daily management routines, through interacting with the public, in developing general or site management plans, or through ongoing efforts to monitor recreational use and use impacts.

Problem Specification

The problem specification stage of the decision process consists of identifying specific resource and visitor experience impacts, describing acceptable levels for each impact, describing the existing level of impact, determining whether the existing impact is acceptable, unacceptable or approaching unacceptable levels, and describing the root cause of the impact (figure 1). Worksheet 1 in the handbook is used to document the problem, its impacts, whether the impacts are acceptable, and the cause of the impact.

Identify impacts

The first step in the problem specification stage is to identify resource or visitor experience impacts. Identifying impacts can be done in a variety of ways. Managers can ask visitors through formal surveys or public meetings what impacts they see occurring. Or, if managers have established indicators and standards for resource and visitor experience impacts through an established planning process—the Visitor Experience Resource

Stages in the decision process	Potential resources for decisionmaking	Appropriate handbook worksheets
1. Problem awareness • Recognize that unacceptable impacts exist and must be addressed	• Statements of park purposes, significance, primary interpretive themes, and specific resource conditions and visitor experiences to be achieved and maintained over time • Observations of park staff • Indicators and standards of quality • Public input	None
2. Problem specification • Identify impact • Describe acceptable impact • Describe existing impact • Determine if existing impact is unacceptable • Identify root cause of impact	• Resource condition and visitor experience data available from: - research - resource use monitoring - public input • Comparison of existing condition with predetermined standard of quality • Public input	Worksheet 1
3. Strategy and tactic selection • Select appropriate strategy • Identify potential tactics • Evaluate and select appropriate tactics	• This handbook • Public input	Worksheet 2
4. Plan implementation • Develop implementation plan for selected management tactics • Identify specific management actions • Identify person responsible for carrying out management actions • Implement actions	• Supervisors, office staff, and field staff determine appropriate tasks and workloads	Worksheet 3
5. Monitoring • Monitor effectiveness of actions • If problem arises, return to problem specification stage	• Resource condition and visitor experience data available from: - research - resource use data - public input • Comparison of existing condition with predetermined standard of quality • Public input • VERP handbook (USDI, NPS 1997a)	None

Figure 1. Stages in the decision process for maintaining the quality of park resources and visitor experiences.

Protection (VERP) planning framework used by the NPS (USDI, NPS 1997a; Hof and Lime 1997) or the Limits of Acceptable Change (LAC) planning framework (Stankey et al. 1985; McCool and Cole 1997) used by the USDA Forest Service and other agencies—they can monitor standards over time to check the impact that visitor use has on the resource or visitor experience.

Some of the more common impacts to the resource are trail deterioration, campsite deterioration, water pollution, wildlife and fishery impacts, and soil compaction (table 1). Some of the more common visitor experience impacts are crowding, visitor conflicts, and noncompliant behavior.

Describe acceptable and existing impacts

Once impacts have been identified, the manager determines what an acceptable level is for each impact. If indicators and standards have been prescribed for an impact, then the acceptable level is the prescribed standard. If indicators and standards do not exist, the manager needs to decide what is acceptable or how much impact can be tolerated before management intervention is required. Managers may be helped in their decision process by involving visitors and other relevant stakeholders in discussions of acceptable levels of resource and visitor experience impacts. Past experience that managers may have had with a specific impact also may be useful in determining an acceptable level of impact.

After the acceptable level for an impact has been determined, the manager needs to describe the existing level of the impact. Again, if indicators and standards exist, the existing impact can be measured and recorded. If no indicators and standards exist, the manager should describe in detail where and when the impact occurs, how much of it occurs, and who or what is impacted.

Determine whether impacts are acceptable, unacceptable, or approaching unacceptable

Determining whether an impact is acceptable or unacceptable can be done in a number of ways. If standards have been established and a system to monitor standards is in place, then values obtained through monitoring can be compared with previously established standards to determine if the existing level of impact is acceptable, unacceptable, or approaching unacceptable levels.

Any impact that is outside the established standard is unacceptable. Unacceptable impacts should be addressed through appropriate management actions to bring them back to acceptable levels. Impacts that meet or are approaching the standard, although still acceptable, might signify deteriorating conditions. In this case, managers might want to

Table 1. Examples of resource and visitor experience impacts.

Resource Impacts

Trail deterioration, trail erosion, excessive trail muddiness, excessive trail width, excessive trail depth/development of tread ruts or grooves; development of social trails.

Campsite deterioration, excessive campsite size, loss of vegetation, erosion of campsite soils, proliferation of tent sites, depletion of dead and downed wood for campfires, proliferation of fire rings; proliferation of campsites.

Cultural resource deterioration, defacement of cultural resources, theft of cultural resources.

Improper disposal of *human body waste*, unacceptable amounts of human body waste at site.

Water pollution, contamination of water body with fecal material, soap residue, chemical substances, or food and animal remains.

Unacceptable levels or types of *litter*, improper disposal of garbage, unacceptable evidence of humans (e.g., trail markers, cairns).

Trampling of *vegetation*, loss of herbaceous vegetation or seedlings, change in species composition, introduction of exotic species, improper collection of specimens, deterioration of grazing areas, trampling of tree roots, nails in trees, peeling of bark, carving initials/words into bark, felling of live trees.

Soil compaction, erosion of organic litter and soil, excessive muddiness, disturbance of cryptobiotic crust.

Wildlife and fishery impacts, destruction or loss of habitat, change in species composition, introduction of exotic fauna, harassment or disturbance of wildlife, competition for food sources, attraction of wildlife, illegal hunting or fishing.

Visitor Experience Impacts

Unacceptable levels of *crowding* at attraction sites; unacceptable number of encounters at trailheads, in visitor centers, on trails, or at campsites; congestion, unacceptable traffic conditions on park roads, lack of available parking spaces.

Visitor conflicts due to incompatible uses, encounters with large groups or parties dissimilar to one's own, rowdiness by itself or in combination with excessive consumption of alcohol, visitor displacement (spatial, temporal, or total).

Noncompliant behavior, vandalism, resource destructive behavior.

Inadequate or inappropriate levels of access to facilities, natural areas, or cultural resources; facility design that fails to accommodate the needs of the broadest possible spectrum of people, including persons with disabilities.

Threats to *visitor safety*, behavior that jeopardizes the safety of the individual or of other visitors, failure to maintain a safe environment through facility design, maintenance, or other means.

consider taking management actions to halt the deteriorating condition before it exceeds the standard and becomes unacceptable. Impacts that are well within the prescribed standards are acceptable and indicate that no change in management is needed at this time.

When standards have not been established, determining what level of impact is acceptable is still possible. However, it can be a time-consuming and controversial task. Managers can ask visitors through formal surveys or public meetings if a specific impact is acceptable or not. Managers can also consult with resource experts to determine whether a particular impact is acceptable.

Unacceptable impacts can be assigned into one of two impact categories: impacts to the resource and impacts to visitor experiences (table 1). These two types of impacts are not mutually exclusive because impacts to resources often heavily influence the quality of the visitor experience. As seen in the table, *unacceptable resource impacts* refer to unacceptable degradation of vegetation, soil, water, wildlife, cultural resources, or facilities. *Unacceptable visitor experience impacts* refer to unacceptable diminishment of the quality of a visitor's experience such as, encountering unacceptable numbers of visitors in an area or coming into contact with other users engaged in incompatible activities or offensive behavior.

An unacceptable impact in one context may not be unacceptable in another context. For example, large numbers of trail encounters is an unacceptable impact in a semiprimitive zone where managers strive to provide visitor experience opportunities characterized by solitude, challenge, and self-reliance. However, this same condition may not be unacceptable in a more developed area where management intent is to provide experience opportunities characterized by ease of access, social interaction, and meeting new people.

Identify causes of unacceptable impacts

When one or more resource or visitor experience impacts are unacceptable, the next step in the problem specification stage is to identify the cause of the unacceptable impact. Strategies and tactics outlined in the handbook will be more or less effective depending on whether the impact is caused by the amount of use, type of use, location of use, timing of use, or visitor behavior within the problem area. Before taking any corrective action, it is important to identify as clearly as possible the root cause of the impact and then select the appropriate strategy and tactics to address the problem.

At times, the root cause may not be obvious. For example, unacceptable levels of soil compaction in many cases might be attributable to too many

people using a particular trail (amount of use). But in some cases, the cause may be that too many people are using the trail during the wet season when soils are saturated and any use results in unacceptable impacts. In this case, timing of use—not amount of use—is the root cause of the problem. To be effective, the solution should address the timing of use on the trail.

Sometimes impacts may be considered spin-off impacts, or an impact caused by another impact. For example, visitor displacement is a spin-off impact caused by factors such as crowding, visitor conflict, campsite deterioration, litter, or specific management actions that detract from the biophysical, social, or managerial settings visitors seek. To address displacement, managers must identify the root causes of it and address them.

Strategy and Tactic Selection

The strategy and tactic selection stage of the decision process consists of thinking in broad terms—thinking strategically—about how to address a problem, and then narrowing the thinking to select specific tactics to resolve the unacceptable impact(s) caused by the problem. Management strategies are general ways in which managers address unacceptable impacts to resources and visitor experiences. *Management tactics* are the means by which a strategy is implemented.

Select appropriate strategy

The first step in the strategy and tactic selection stage is to choose an appropriate strategy to address the unacceptable impact. Managers can use this handbook to help them select a strategy. Or, they can hold public meetings with visitors and other relevant stakeholders and use the handbook to help them arrive at a strategy. Worksheet 2 provides a space for managers to note the strategy(s) selected.

Over the past 30 years, researchers have identified and analyzed a number of strategies for addressing unacceptable impacts to resources and visitor experiences. Five primary strategies have resulted:

- Modify the character of visitor use by controlling where use occurs, when use occurs, what type of use occurs, and how visitors behave.
- Modify the resource base by increasing resource durability or maintaining/rehabilitating the resource.
- Increase the supply of recreation opportunities.
- Reduce use in the entire area, or in problem areas only.
- Modify visitor attitudes and expectations.

These five strategies are appropriate for both frontcountry and backcountry settings. Managers are encouraged to consider all of the strategies before selecting one or more to address specific unacceptable impacts. A combination of strategies works best to solve many unacceptable impacts to the resource and visitor experiences. Using a combination of strategies provides managers with flexibility to address the multiple dimensions and causes of unacceptable impacts. The particular strategy(s) selected will depend on the kinds of conditions to be achieved and whether the existing impact is unacceptable or approaching unacceptable levels. For example, if the condition the manager wants to achieve is a primitive setting, then modifying the character of visitor use is a more appropriate strategy than modifying the resource base. Alternatively, modifying the resource base to increase the resource's durability is an appropriate strategy when the condition to be achieved is to allow as many people as possible to experience something such as an outstanding geologic feature—Old Faithful geyser in Yellowstone National Park, for example.

When impacts are acceptable or even when they are approaching unacceptable levels, an indirect or persuasive strategy is more appropriate than a direct or restrictive strategy. The latter is more appropriate when an impact is clearly unacceptable. Strategies to increase the supply of recreation opportunities, modify the resource base, and modify visitor attitudes and expectations are generally considered indirect. Strategies to reduce use and modify the character of use are generally considered direct.

Identify potential tactics

The next step in the strategy and tactic selection stage is to brainstorm all of the potential tactics that might be used to resolve a specific unacceptable impact. The brainstorming session can be with the manager and staff or with the manager, staff, and stakeholder groups. This handbook, especially the descriptions and evaluations of the advantages and disadvantages of each tactic, as well as the material in this section, should serve as a valuable resource to the group's discussion. Worksheet 2 should be used to help guide the discussion and keep track of specific comments group members have about specific tactics.

The handbook describes 25 management tactics (table 2). For ease of discussion, the tactics are grouped into five broad categories: (1) site management, (2) rationing and allocation, (3) regulations, (4) deterrence and enforcement, and (5) visitor education. Each category represents a distinct approach to resolving unacceptable impacts to the resource and visitor experience.

Table 2. Tactic categories and tactics associated with them.

Tactic Category	Tactics
Site Management	• provide facilities and structures • use vegetation • use physical barriers • increase (decrease), improve (not improve) or eliminate facilities • strengthen/harden sites • remove litter and other problems • close areas or facilities
Rationing and Allocation	• limit access using reservations • limit access using a first-come first-serve (queuing) system • limit access using lotteries • limit access using merit/eligibility system • charge fees
Regulation	• restrict access to specific locations (zoning) • restrict use/behavior at facilities • restrict/prohibit activities • restrict/prohibit equipment • restrict/prohibit modes of travel • limit length of stay • limit group size/stock/pets • restrict/prohibit use to protect environmental conditions
Deterrence and Enforcement	• provide signs • sanction visitors who engage in noncompliant behavior • provide personnel and law enforcement
Visitor Education	• educate visitors about appropriate behaviors • educate visitors to to alter use patterns

Some categories are more appropriate for impacts related to the resource and others are more appropriate for impacts related to visitor experiences. For example, site management tactics are directly related to manipulating the biophysical resource in some way. Tactics outlined in the other categories are related to management of the visitor or visitor behavior. Before choosing a tactic or set of tactics, the manager should look at all the tactics and note which one(s) might apply to resolving the problem.

In general, several tactics will be used to implement a particular strategy. For example, if the number of people in an area at one time is unacceptable, managers might select "modify the character of use in the area by controlling when use occurs" as a strategy. One tactic relevant to this strategy might be to "provide visitor education to alter use patterns." This tactic could be implemented by informing visitors, through visitor education efforts, about when and where use occurs so they have better information to plan their trips. Another tactic relevant to implementing this strategy might be to "charge fees"—charge higher fees during periods of high use and/or high impact potential. It is found in the rationing and allocation category. Other tactics as well could be used to implement this strategy. By identifying all tactics that might potentially be appropriate to resolve a particular unacceptable impact, managers increase the likelihood that they will implement the most appropriate tactic(s) to meet their overall strategic purpose.

Evaluate and select tactics

The last step in the strategy and tactic selection stage is to evaluate and select tactics. Theoretically, any management strategy, consistent with acceptable impacts for an area, can be implemented to enhance resource or visitor experience conditions. The same is not true of tactics, however. When selecting tactics, site-specific factors—location of use, timing of use, type of use, kinds of visitor behavior occurring, and so on—and the tradeoffs among these factors need to be discussed and evaluated before a tactic is chosen and subsequently implemented.

The evaluation and selection of final tactics is probably best accomplished by managers and their staff through group discussion. This handbook, especially the descriptions and evaluations of the advantages and disadvantages of each tactic and the material in this section, should serve as a valuable resource to the group's discussion. Worksheet 2 in the handbook is meant to serve as a guide for final tactic selection. The comments entered on Worksheet 2 during the previous step also should be useful in selecting tactics to implement.

Managers must consider a variety of selection criteria before choosing tactics to implement. At least 11 criteria have been identified by various researchers (Gilbert et al. 1972; Lime 1976, 1979; Manning 1979; Peterson and Lime 1979; Lucas 1983; Brown et al. 1987; Cole et al. 1987, 1989b; Graefe et al. 1990; McCool and Christensen 1996) that are helpful in evaluating whether a specific tactic should be selected to resolve an unacceptable impact (table 3). The first criterion helps focus the group on the problem. The next two criteria guide the group's thinking toward selecting tactics that do not conflict with visitor experience opportunities managers are providing in the problem area. After these first three criteria have been addressed, the remainder of the criteria need to be addressed, but in no particular order.

When selecting final tactics managers should begin by focusing on these first three criteria:

- Does the tactic adequately address the root cause of the problem?
- Is the tactic direct or indirect?
- Is the tactic subtle or obtrusive?

Address the root cause: Managers should always choose tactics that address the root cause of the problem. Tactics addressing the root cause will be most effective in resolving unacceptable impacts to the resource and visitor experiences.

Direct versus indirect tactics: Direct management tactics operate directly on visitor behavior and restrict behavior in some way. Indirect tactics target the decision factors that influence visitor behavior. These tactics attempt to persuade visitors to behave appropriately.

The use of barriers (fences, rocks, logs, etc.)—a site management tactic—would generally be considered a direct tactic because it directly impacts visitor behavior. The visitor must stop when the barrier is encountered. Requiring visitors to reserve a permit to enter an area is a direct tactic because the visitor cannot enter without the permit.

An indirect tactic could be any tactic listed in the visitor education tactic category. These tactics strive to inform visitors about an area or particular site within an area and then try to influence or persuade visitors to behave in a specific way. For example, visitor education efforts to inform visitors of high use periods and the potential impacts that encountering large numbers of people will have on their experience may influence some visitors to come at a lower use time to avoid such use. Information distributed to visitors about "leave no trace" camping attempts to influence visitor behavior. In

both cases, visitors are not told what they must do, but rather they are given information to help them make appropriate choices.

Table 3. Selection criteria for management tactics.

Does the tactic adequately address the root cause of the visitor use problem?
Is the tactic direct or indirect in terms of how it operates on visitor behavior?
Is the tactic subtle or obtrusive in terms of visitor awareness of being managed?
Does the tactic preserve visitor freedom of choice?
Does the tactic affect visitors offsite during the planning stages of their trip? Or does the tactic affect visitors onsite while they are engaged in their recreational experience?
Does the tactic affect a large or small number of visitors? Are those affected primarily visitors who are generally not responsible for the impact(s) in question?
Does the tactic affect an activity to which some visitors attach a great deal of importance?
Are visitors likely to resist the management action?
What are the costs to managers in terms of tactic implementation and administration, including facility construction, operation, and maintenance, staff workload, and communication and enforcement costs? Are any of these limiting factors?
How effective is the tactic likely to be at solving the visitor use problem in question?
Is the tactic likely to lead to the creation of a new problem?

Based on manager's field experience and past research, McCool and Christiansen (1996, pg. 76-77) summarize that:

- Visitor support for direct tactics is highest when the rationale is understood and the benefits can be visualized.
- Visitor support for direct tactics is highest in national park settings, least in backcountry and designated wilderness.

- Visitor support is highest in settings with a tradition of direct tactics, lowest in settings that are proposing increased direct tactics.
- Visitor support for direct tactics is highest for tactics with which they are familiar, least for new tactics.
- While visitors accept many tactics, they prefer indirect tactics.
- Preferences and acceptability of direct tactics are influenced by visitor motives for visiting the setting.
- Visitors prefer tactics administered external to a backcountry setting compared to those administered internally.

The final selection of tactics frequently comes down to a manager's best judgement. Which type, direct or indirect, to use is situation dependent. Careful consideration of the nature of a specific tactic is essential for sound decisionmaking.

Subtle versus obtrusive tactics: Whether the selected tactics are direct or indirect, another consideration the manager needs to take into account is how the tactic is "enforced." Subtle enforcement of a tactic means visitors may not perceive that their behavior is being controlled. Obtrusive enforcement of a tactic means visitors are immediately aware that their behavior is being controlled. For example, managers might choose to prohibit off-trail travel within a specific zone, a direct management tactic. Enforcement of the tactic could be through informational signing along the trail—subtle enforcement. Or, enforcement of the tactic could be through stationing a uniformed enforcement officer in the zone to enforce the tactic by aggressively pursuing those who wandered off the trail and ticketing and fining them—obtrusive enforcement. Unless there are good reasons not to, managers should attempt subtle enforcement of tactics before they resort to obtrusive enforcement. Subtle enforcement of tactics, whether direct or indirect, tends to preserve visitor freedom of choice.

Once these first three selection criteria (table 3) have been addressed, the other criteria listed need to be discussed and the questions they raise answered. When the group has completed their discussion of all the criteria, they need to select the tactics they will use to resolve their specific unacceptable resource and visitor experience impacts. The group should select the tactic(s) they believe are most appropriate to their specific problem. Appropriate tactics are ones for which the manager has the budget, personnel and expertise to implement. In some cases, the final tactics to select will be obvious because there are few, if any, alternatives. More frequently, though, managers must weigh the selection criteria carefully and rely on their best judgement to choose tactics best suited to the particular unacceptable impacts they have.

Plan Implementation

The fourth stage in the decision process is the plan implementation stage. In this stage managers develop an implementation plan for the management tactics they selected in stage three of the process. Worksheet 3 is provided as a suggested framework for the implementation plan.

Without a tactic implementation plan, unacceptable impacts will remain. Tactics by themselves are not management actions. They suggest a particular course of action but they do not specify the actions managers must take to resolve unacceptable impacts. Each tactic selected in stage three of the process may have one or more specific management actions attached to it. For example, the problem may be a decrease in water quality in backcountry lakes. The unacceptable impact might be high levels of fecal coliform in the lake. In this case, the root cause of the impact is improper disposal of human waste. The strategy selected is to modify the character of use by changing how visitors behave. The primary tactic selected to change visitor behavior is to provide backcountry visitors with educational material on how to dispose of human waste properly. To implement this tactic, managers will need to engage in actions that might result in the development of educational material, the distribution of it, and perhaps some process to assure that visitors read and understand the material.

Guidance for selecting appropriate management actions can come from this handbook, discussions with managers in other parks or natural resource areas, or the group's experiences with a particular management action.

Monitoring

Management actions must often be viewed as experiments. The ability of managers to predict the consequences of actions is limited because there is much uncertainty about how people interact with natural and cultural resources. Monitoring provides feedback to managers about the consequences of implementing specific management actions. This feedback may inform managers that their actions are successful at solving the problem and should be continued. On the other hand, monitoring data may tell managers that their actions are not correcting the problem or are causing new problems. In this case, the decision process for managing social and ecological impacts of recreation use should be revisited.

The amount of time, money, and personnel needed for monitoring activities is often grossly underestimated. Monitoring is an ongoing, long-term undertaking, which, when properly conducted, improves manager awareness of resource and visitor experience impacts. A useful resource for managers to consult who want to set up a monitoring program is the Visitor Experience and Resource Protection (VERP) Framework: A Handbook for

Planners and Managers (USDI, NPS 1997a) as well as other recent publications by Marion (1991) and Cole (1989c).

Part Two

Using the Worksheets

This section of the handbook provides examples of worksheets and instructions for their use. The worksheets are used for the problem specification, strategy and tactic selection, and plan implementation stages of the decision process. The worksheets are guides and managers are encouraged to modify them if needed. The purpose of the worksheets is to focus discussion on a specific unacceptable impact associated with a problem and come up with specific management actions to resolve the impact. Another purpose of the worksheets is to serve as documentation of when, how, and why decisions were made. It also can be useful information for managers at other parks who are trying to solve similar problems. Or, it can be used to help answer the public's questions about specific management actions.

These worksheets have been field tested with a variety of NPS personnel. One of the comments park personnel made was that the worksheets needed to be flexible to fit different park management styles and different kinds of park problems. We have tried to develop worksheets that address the key components of the decision process. Any of these worksheets may be modified to fit different management work styles or problems. Whether the worksheets outlined in the handbook are used "as is" or are modified, the decision process is successful when the following critical components are addressed and linked to one another:

- Statement of the problem
- Unacceptable impact related to the problem
- Strategy related to resolving the unacceptable impact
- Tactics related to the strategy chosen to resolve the unacceptable impact
- Specific management actions to address the unacceptable impacts linked to the tactics selected

Worksheet 1

Worksheet 1 is used for the problem specification stage of the decision process. The first line of the worksheet is reserved for the manager or group to write a clear description of the problem. The problem may be something as broad as "it's too crowded at Scenic Arch." Or it may be something as specific as "every Sunday evening, after most of the campers have left the campground, there's too much litter in the campsite fire grates."

Once the problem statement is filled in, go to the first column of the worksheet and list the *impacts believed to be related to the problem*. The

list of impacts is generated individually or in a brainstorming session with appropriate staff and other stakeholders. The worksheet has room to list up to six different impacts. Of course, more than six impacts may be identified. Simply extend the worksheet to list additional impacts.

For each impact listed in the first column, identify the acceptable level of that impact. Write the acceptable level for the impact in column two. If indicators and standards have been developed for the area (e.g., using the VERP framework) that address a specific impact, then the acceptable level of the impact is the prescribed standard. When prescribed standards exist, enter them in column two opposite the appropriate impact in column one. When prescribed standards do not exist, the individual or group must make a "best educated guess" about the acceptable level of impact and enter that description or statement in column two. Past research, colleagues in other resource areas, past and current visitors, and other resources are helpful in developing a best educated guess.

Column three asks for the existing impact. Information in this column should state specifically when the impact occurs, where it occurs, and how much of it is occurring. If the area has a monitoring plan in place that monitors impacts listed in column one, then the information for the existing impact's column will come from the monitoring results. If there is no monitoring plan in place, then the information entered in this column might come from observations made by managers and their staff, comments made to management by visitors, or from both observations and comments.

The next column on the worksheet is for recording whether the amount of the impact is acceptable, unacceptable, or approaching unacceptable levels. Again, if standards have been developed for the impacts listed in column one, then determining whether an impact is unacceptable is done by comparing acceptable impact data with existing impact data. If prescribed standards do not exist, then the group must use its best educated guess to determine whether an impact is acceptable, unacceptable, or approaching unacceptable levels.

In general, if the existing impact is well below the standard set for an acceptable level of impact, then the existing impact is acceptable and does not require management action. If the existing level of impact is about the same as the standard set for acceptable levels of impact, then the existing impact is approaching the standard and management actions may be required so that the impact does not exceed acceptable levels. If the existing level of impact is greater than the standard, then the impact is unacceptable and management action is required.

The last column of worksheet one is used to record the root cause of the impact. If the group or manager has determined that an existing impact is acceptable, there is no need to determine a root cause.

Once worksheet 1 has been filled out, the next step is to decide which impacts require management actions. Generally, any unacceptable impact and some impacts that are approaching the standard, will require management actions. Review column 4 and circle all impacts that are unacceptable or approaching the standard. The circled impacts are the ones that will require management actions to resolve.

Worksheet 2

Worksheet 2 is used for the strategy and tactic selection stage of the decision process. Worksheet 2 is filled out for each impact circled on worksheet 1. To begin worksheet 2, the manager transfers the problem statement from worksheet 1 to the first line of worksheet 2. On the second line of worksheet 2, the manager enters one of the unacceptable impacts circled on worksheet 1.

Once the problem and unacceptable impact have been entered on worksheet 2, the manager, staff, and possibly stakeholders need to decide what strategy(s) they will use to remove or resolve the unacceptable impact. The next section on the worksheet lists the five possible strategies. The group should review and discuss each strategy. Based on discussions of the advantages and disadvantages of each strategy for addressing the unacceptable impact listed at the top of worksheet 2, choose the strategy(s) the group thinks will most likely resolve the impact. Place a check next to that strategy(s) on the worksheet.

The rest of worksheet 2 is used to guide selection of appropriate tactics to resolve the unacceptable impact. The tactics are listed down the left side of the worksheet by tactic category. The right-hand side of the worksheet is reserved for comments and/or notes the group may have about a particular tactic and its use for the impact under consideration. Page numbers, shown in parentheses after each tactic category, refer to areas in the handbook where the group can find explanations and descriptions of each tactic and its purpose, its costs to managers and visitors, and its effectiveness.

To select tactics, first look at the overall strategy chosen. If the strategy chosen is to “modify the character of use by controlling where use occurs,” then look through all of the tactics and decide which might be appropriate for this strategy. Place a check next to all the tactics the group thinks are appropriate. Once all possible tactics that might be appropriate for the strategy selected to resolve the impact under consideration are checked, go

back and discuss each tactic. Discussion should include whether the park has the resources—time, money, and personnel—to implement the tactic. Discussion should also include the effect the tactic will have on the resource and visitor experiences. For example, how direct or indirect is the tactic and will it be implemented in a subtle or obtrusive manner? Write key discussion comments in the space provided to the right of the tactic.

After all tactics have been discussed, go back through the list of tactics checked. Read all the comments and continue discussions if necessary. Based on the discussion and comments, circle those tactics the group believes will most likely resolve the unacceptable impact noted at the top of the worksheet.

Worksheet 3

Worksheet 3 is used as a guide for developing an implementation plan. An implementation plan, which outlines specific management actions, must be developed if the impact is to be resolved. The implementation plan specifies management actions needed to implement tactics selected to resolve the unacceptable impact.

Worksheet 3 should be completed for each unacceptable impact circled on worksheet 2. To begin worksheet 3, the manager transfers the problem statement from worksheet 1 to worksheet 3. Next, the manager transfers the unacceptable impact noted on worksheet 2 to worksheet 3.

Once the problem and unacceptable impact lines are filled in, proceed to the next section on the worksheet. This section has five parts. In the first part, the manager enters one of the tactics circled on worksheet 2. Then, in the first column, the manager lists the specific management actions that will need to be taken to implement the tactic. The worksheet provides space for 4 different management actions. The manager should enter as many management actions as are needed to implement the tactic. In the second column, the manager enters the name of the person(s) who will be responsible for carrying out each management action. The third column provides space to enter the time frame in which the action will be carried out, and the fourth column is for any additional comments the manager or group wants to make about the actions listed.

The section of worksheet 3 described above should be filled out for each tactic circled on worksheet 2. Often the number of tactics circled—hence the number of times the manager or group will need to complete this section of the worksheet—depends on the complexity of the problem, park personnel's expertise in implementing actions related to a specific tactic, and budgets.

Worksheet 1: Problem Specification

Statement of the Problem:

Specific impacts related to the problem	Acceptable impact	Existing impact (include when and where it occurs and how much of it occurs)	Determine whether existing impact is:			Root cause of unacceptable impact or why impact is approaching unacceptable
			acceptable	unacceptable	approaching unacceptable	

Worksheet 2: Selecting Strategies and Tactics

Statement of the problem (from Worksheet 1): _____

Unacceptable impact related to the problem (from Worksheet 1): _____

Check the strategies you believe are most likely to resolve the unacceptable impact.

_____ Modify the character of use by controlling where use occurs, when use occurs, what type of use occurs, and how visitors behave.
_____ Modify the resource base by increasing resource durability, maintaining/rehabilitating the resource.
_____ Increase the supply of recreation opportunities.
_____ Reduce use in the entire area, or in problem areas only.
_____ Modify visitor attitudes and expectations.

Check tactics you believe are related to the strategies you selected above and you think are most likely to resolve the problem.
(For detailed explanation of each tactic, see Handbook, page ___ to ___.)

Tactics	Comments/Notes
Site Management (Handbook pgs 29 to 50) ___ provide facilities and structures ___ use vegetation ___ use physical barriers ___ increase (decrease), improve (not improve), or eliminate facilities ___ strengthen/harden sites ___ remove litter and other problems ___ close area or facilities	
Rationing and Allocation Handbook pgs 51 to 72) ___ limit access using reservations ___ limit access using a first-come-first-serve (queuing) system ___ limit access using lotteries ___ limit access using merit/eligibility system ___ charge fees	

Worksheet 2: Selecting Strategies and Tactics (continued)

Tactics	Comments/Notes
Regulation (Handbook pgs 73 to 100) ___ restrict access to specific locations (zoning) ___ restrict use/behavior at facilities ___ restrict/prohibit activities ___ restrict/prohibit equipment ___ restrict/prohibit modes of travel ___ limit length of stay ___ limit group size/stock/pets ___ restrict/prohibit use to protect environmental conditions	
Deterrence and Enforcement (Handbook pgs 101 to 110) ___ provide signs ___ sanction visitors who engaged in noncompliant behavior ___ provide personnel and law enforcement	
Visitor Education (Handbook pgs 111 to 120) ___ educate visitors about appropriate behaviors ___ educate visitors to alter use patterns	

Worksheet 3: Implementation Plan

Statement of the problem (from Worksheet 1): _____

Unacceptable impact related to the problem (from Worksheet 2): _____

Tactic selected to address unacceptable impact (from Worksheet 2): _____

Specific management action(s)	Person responsible	Time frame for implementing action	Comments
1.			
2.			
3.			
4.			

Part Three

Describing Management Tactics

This section of the handbook is divided into five sections. The five sections represent the five management tactic categories outlined in Part One of the handbook. Twenty-five individual tactics are described and evaluated. Each section includes an overview of the tactic category and a description of each tactic within the category. In addition, at the end of each tactic write-up, selected references are listed that may help some managers and other interested readers better understand a specific tactic.

Site Management

provide factilites and structures

use vegetation

use physical barriers

increase (decrease), improve (not improve), or eliminate facilities

strengthen/ harden sites

strengthen/ harden sites

close areas or facilities

Site Management

The purpose of site management is to direct and channel use, and to maintain desired environmental conditions. There are many unacceptable impacts to resource conditions that site management tactics can address, including loss of vegetative cover, change in species composition, soil compaction, soil erosion, water pollution, damage to trees and seedlings, damage to or loss of cultural resources, introduction of exotic species, harassment and/or displacement of wildlife, and improper disposal of human body waste.

For example, as soil moisture content increases, resistance to impact decreases. Although soil compaction results in a variety of impacts, the impact of greatest concern is decreased water infiltration. Trampling eliminates broad-leafed herbaceous species and tree seedlings, although open woodlands and meadows tend to be more resistant to moderate trampling (McEwen and Tocher 1976). Furthermore, impacts to resources tend to occur relatively quickly after initial use, while recovery rates are relatively slow (e.g., Hammit and Cole 1998, Liddle 1997). As long as some recreation use occurs, these impacts cannot be eliminated entirely. However, the impacts identified above can be minimized by the effective use of site management tactics.

One of the most important goals of site management is to direct or concentrate use. Hammit and Cole (1998), for example, encourage managers to concentrate use at a series of nodes and linkages. Some researchers emphasize the importance of facility design in preventing problems typically attributed to "overuse." Hultsman et al. (1987), for example, suggest that poor planning, inadequate design, and lax administration are responsible for many of the unacceptable impacts to resource conditions attributed to visitors. Site management efforts can be implemented at any time during an area's development, including the planning, construction, and maintenance stages. Additionally, facilities may be closed or eliminated and specific areas may be closed temporarily or permanently depending upon resource conditions and management objectives.

In addition to their importance in resolving unacceptable impacts to resource conditions, site management tactics also have an impact upon the quality of visitor experiences. In the USDA Forest Services' studies of river recreation visitors in the 1970s and 1980s, visitors frequently indicated that the top three impacts to resources and visitor experiences they encountered were litter, too few toilets, and too few drinking water sources (Knopf 1982, Knopf and Lime 1984). These impacts all have site management implications. Although managers frequently attempt to reduce littering behavior through visitor education and deterrence/enforcement

efforts; once littering occurs, the only solution is to remove it physically. Placing trash receptacles in strategic locations is another important site management tactic (i.e., increase the number of/improve/do not improve/or eliminate facilities). Visitor complaints about inadequate support facilities highlight the fact that visitor comfort and convenience cannot be overlooked in site management efforts. Schomaker and Knopf (1985) interpreted the results of the river recreation studies by concluding that visitors want easy and comfortable access to the river; they do not want to see development once on the river.

Site management tactics can stand alone as a means to address unacceptable impacts. Most often, however, they form part of an integrated approach in which several types of tactics are used. For example, under the site management tactic "Increase (decrease), improve (not improve), or eliminate facilities," a variety of facility improvements may be considered. One option is to develop a visitor transportation system (VTS) to manage congestion problems and concentrate use. VTSs may be optional or mandatory for visitors. If use is optional, VTSs fulfill primarily a site management function. At the same time they provide opportunities for interpretive services and visitor education. If the use of a VTS is *required* of all visitors, the VTS incorporates both a site management and a regulatory function (i.e., mode-of-travel regulation). Furthermore, if reservations to board the VTS are limited, the VTS expands to encompass three distinct categories of management tactics: site management, rationing and allocation, and regulation. In addition, visitor education may be integrated into the day-to-day operation of the system, which allows the VTS to interface with four distinct categories of management tactics.

Seven site management tactics discussed in this section are:

- provide facilities and structures
- use vegetation
- use physical barriers
- increase number (decrease), improve (not improve), or eliminate facilities
- strengthen/harden sites
- remove litter and other problems
- close areas or facilities

Provide facilities and structures

Purpose

Providing facilities and other visitor structures is a management tactic that prevents unacceptable visitor-caused impacts to resources and visitor experiences from occurring.

Description

Providing facilities and structures is an important component of the planning and management of a recreation area. Properly designed facilities allow desired resource and experiential conditions to be maintained, thus contributing to quality visitor experiences. Facilities often function to shield a site from impact, in this way they contribute to maintaining resource conditions.

A principal aim of facility design is to limit the areal extent of impacts to resources by concentrating use. Before designing or redesigning facilities, managers may need to inventory area soils, vegetation, and geomorphology to identify durable sites for facility placement.

Six elements of design psychology may be used to eliminate unaacceptable impacts to visitor experiences. These elements include: (1) curvilinear design; (2) blending human-made with natural colors; (3) designing to avoid confusion; (4) designing facilities to be compatible with adjacent uses; (5) designing to the human scale; and (6) lighting aesthetics (Hultsman et al. 1987).

Facility design or redesign is a useful management tactic for addressing a variety of unacceptable impacts to resources and visitor experiences. That is, poor facility design is often a leading cause of unacceptable impacts. For example, facilities may fail to meet accessibility requirements for persons with mobility disabilities. If the grade of a trail is too steep, the angle of turns too sharp, or the overlook to which it leads is surrounded by a 4-foot high stone wall, these aspects of the design environment can impact the experience of persons with disabilities. In addition, handrails may function to keep hikers from wandering off the trail. If a handrail does not exist along a segment of a trail in which undesired social trails are developing, facility redesign (e.g., adding a handrail) is a management tactic that addresses the underlying cause of the social trail development, at least at some level.

Facility design can be a direct management tactic. For example, separating an area designed for passive waterfront activities from a boat launch will channel potentially conflicting uses to different areas. On the other hand, facility design may function indirectly as well. Sites may be designed either

to attract visitors or to discourage visitation. For example, the way in which vegetation is used at access points may arouse visitor interest or convey the sense of a dark, uninviting route. The visitor chooses where to go, but the site characteristics influence the decision.

Finally, aspects of facility design may be either *subtle* or *obtrusive*. The path a nature trail follows is a readily apparent element of facility design. What may be far less apparent, however, is the way a designer might route a trail close to or away from certain features (e.g., a lake) to discourage noncompliant or other inappropriate behaviors.

Costs to visitors

Low to Moderate. Facility design detracts from visitor experience to the extent that facilities are lacking, facility capacities are insufficient, or facilities are poorly designed or inappropriate given desired recreation experiences. Inadequate facility design may exacerbate actual or perceived crowding, as well as visitor use conflicts. However, if facility design provides for adequate facility capacities and convenience, while contributing to acceptable setting characteristics, it should not detract from visitor experience.

Costs to management

Moderate to High. Facility design presupposes that funding for new facilities is available. The financial costs of both the design and construction phase of the project can be substantial. Managers often lack the expertise to design or redesign facilities effectively, which necessitates hiring consultants or subcontracting with outside agencies. For these reasons, the cost of facility design to management may be, but need not always be, considerable.

Effectiveness

Moderate to High. Facility design has proven to be an effective way to channel use, thus reducing the areal extent of impacts to resources. The extent to which facility design indirectly influences visitor behavior in recreational settings is not well documented. One trail study suggests, though, that even if a facility (low-lying scree wall) provides nothing more than a simple reminder to stay on the trail, that facility can lead to a substantial decrease in the development of social trails, an unacceptable impact (Doucette and Kimball 1990).

Redesign has proven effective at Mt. Rainier National Park where off-trail travel was substantial. Observers recorded where visitors traveled off-trail and why. Existing trails did not provide access to snowy areas that visitors

liked to visit. Trails were therefore redesigned to accommodate these visitor needs and off-trail travel was greatly reduced.

After observing transportation problems within the park, Acadia National Park implemented a one-way road system to replace their previous two-way road system. This facility redesign effort was effective in reducing congestion.

In a 1991 survey of 93 NPS backcountry managers, Marion et al. (1993) found that 34 percent of the parks relocated backcountry campsites from fragile to durable soils or vegetative types, while 43 percent concentrated use on-site through firepit and facility placement. In addition, 13 percent of parks provided tent platforms for backcountry campers, 30 percent provided some type of firegrate, 20 percent provided tables, and 4 percent provided hitching rails. These facility design features helped managers to maintain acceptable resource conditions.

Selected references

Beardsley et al. 1974; Cole et al. 1987; Doucette and Kimball 1990; Echelberger et al. 1983; Fogg 1981; Hammit and Cole 1998; Hultsman et al. 1987; Hultsman and Hultsman 1989; Manning et al. 1996; Marion et al. 1993; McEwen and Tocher 1976; Rutledge 1986.

Use vegetation

Purpose

Vegetation is used to rehabilitate an area with sustained unacceptable impacts, to shield areas not intended for visitor use, or as a screen to reduce visual impacts and facilitate noise reduction.[1] Vegetation may be modified to enhance visitor enjoyment or to protect soil and plant communities.

Description

Using vegetation to address unacceptable visitor-caused impacts to resources and visitor experiences is a management tactic that may be used to target the cause of an impact. For example, in a developed campground, if there are impacts to visitor experiences because of a perceived lack of privacy, vegetative screening will reduce these adverse impacts. Assuming proper facility design, screening should be adequate to alleviate the perceived lack of privacy. On the other hand, if vegetative cover were reduced at a site because of off-trail travel, revegetation would not address the cause of the problem (i.e., off-trail travel). In this case, revegetation might be used along with a management tactic such as educating visitors about appropriate behaviors.

Use of vegetation is an indirect management tactic. For example, if trampled vegetation provides evidence that previous visitors have traveled off-trail, later visitors may follow suit. However, if the evidence of off-trail travel is removed through vegetative restoration, research suggests that subsequent visitors will be less likely to travel off-trail (e.g., Vande Kamp et al. 1994a,b). The removal of the evidence of previous noncompliant behavior to encourage future compliance is an indirect approach to controlling visitor behavior. Similarly, well-maintained vegetation in frequently visited areas may activate behavioral norms regarding appropriate resource-protective behavior, thus indirectly preventing undesired impacts to resource conditions.

Vegetation may be used in either a subtle or an obtrusive manner. Vegetation may be strategically placed, thus subtly directing visitor use to designated impact zones. However, when vegetation is intended to function as a barrier, and when this function is evident to visitors, use of vegetation will be more obtrusive, possibly detracting from the quality of visitor experiences. In addition, visitors are likely to differ in their views of how subtle or obtrusive vegetative management practices are. For example,

[1] Discussion of the use of vegetation as a *barrier* is also found under the site management tactic of "use physical barriers."

a visitor survey at Roosevelt Campobello International Park revealed that younger visitors rated the management practice of vista clearing less favorably than older visitors, presumably due to differing perceptions regarding the obtrusiveness of the management action and its effect in conserving the natural appearance of park landscapes.

Site restoration efforts, which frequently include intensive revegetation, are generally less successful than simply concentrating visitor use into already impacted areas. Revegetation of areas generally requires from 3 to 20 years. Following this relatively long recovery period, restored areas often revert to their previous highly impacted state under even conditions of light use (Hammit and Cole 1998).

Some vegetative management techniques, however, have been shown to be effective in maintaining desired biophysical conditions. Planting shrubs in intersite areas allows for the protection of small seedlings and herbaceous ground cover. Depositing appropriate amounts of leaf litter assists in water infiltration. Planting resistant species and discouraging the use of nonnative species is also effective. Finally, removing vegetation to allow for facility development or to enhance visitor safety or the quality of visitor experience (e.g., vista cutting, to prevent overshading, to eliminate the tunnel effect along road corridors, or to provide for visitor safety especially in urban parks) is effective also.

Costs to visitors

Low to Moderate. Vegetation used to block or hinder access to an area, limits visitor freedom of choice and may result in decreased enjoyment whether or not visitors choose to bypass the barrier. Costs to visitors are minimized if the vegetation's function as a barrier is unobtrusive. Vista clearing, as a form of vegetative management, may enhance some recreation experiences (e.g., enjoying scenery), while detracting from others (e.g., enjoying an unaltered natural environment). Costs to visitors tend to increase to the extent that the environment is modified from an existing natural state. In developed areas, however, landscaping efforts and the presence of greenery contribute positively to visitor experience.

Costs to management

Low to Moderate. Modifying vegetation to ensure that acceptable biophysical, social, and managerial conditions are maintained is generally a cost-effective management tactic. Periodic maintenance costs are common, though costs are rarely prohibitive.

Effectiveness

For vegetative barriers, effectiveness is not determined by erecting a barrier that is impassible. Instead, effectiveness is based on whether bypassing the barrier is perceived to be worth the effort, and/or whether the visitor recognizes management intent and chooses to comply. Vegetative screening is an effective way to reduce noise and enhance a sense of privacy at developed campgrounds. Revegetation is generally considered ineffective if, following the restoration period, the site is to be reopened to visitor use. However, if revegetation is intended to reduce noncompliant visitor behavior, such as off-trail travel, efforts may be successful in the long run.

In a survey of NPS backcountry managers, Marion et al. (1993) discovered that in 27 percent of parks surveyed, vegetation is transplanted or seeded on backcountry sites. In 19 percent of the parks surveyed, trees or shrubs are planted on backcountry campsites.

Selected references

Deblinger et al. 1989; Hammit and Cole 1998; Hultsman et al. 1987; Manning et al. 1996; Manning and Smith 1992; Marion et al. 1993.

Use physical barriers

Purpose

Physical barriers function to control visitor behavior, ensure visitor safety, protect resources, prevent such noncompliant behavior as vandalism or off-trail travel, and maintain desired traffic flow patterns.

Description

A physical barrier is designed to obstruct or direct visitor movement and to separate visitors from the resource and/or each other. The use of barriers addresses unacceptable impacts to resources and visitor experiences caused by inappropriate traffic flow or use patterns. For example, visitors on a trail that handles two-way traffic to a popular attraction site may find their movement hindered by oncoming pedestrian traffic. A solution is to separate the two-way traffic with a simple rope or fence barrier. Barriers are more commonly used to block or hinder access to an area, or to prevent off-trail travel.

Barriers may be a direct or indirect management tactic. Barrier design, as well as the materials from which the barrier is made, determine whether the barrier functions directly or indirectly. If the barrier is a physical barrier that visitors cannot bypass without extreme difficulty, then the barrier functions as a direct management action. An example of a barrier of this sort would be a road block, which prevents vehicular access.

Most barriers do not preclude the possibility of visitor bypass, and thus are indirect because they influence the decision factors that affect behavior. For example, the use of vegetation or a low riding polypropylene rope as a barrier is not an insurmountable obstacle to the visitor. Barriers of this sort rarely act as a physical barrier, but rather exert their influence either by disguising the presence of a feature such as a trailhead, or by activating visitor norms about the desirability of complying with management intentions.

As with most tactics, the use of barriers is often carried out in conjunction with other management tactics. For example, using barriers together with good facility design and properly targeted visitor education programs will increase the likelihood that visitor use is concentrated in designated impact areas.

Costs to visitors

Moderate to High. The intent of barriers is to reduce visitor freedom of movement. And as such, barriers may represent a significant cost to visitors. The visual impact of barriers also could contribute to visitor cost by reducing the perceived naturalness of an area. If the quality of visitor

experiences is improved through the reduction of unacceptable impacts, benefits may out weigh costs. In addition, costs to visitors can be reduced by explaining the reasons behind the use of barriers, particularly if, as a result of the explanation, the visitor understands the need for a barrier. Visitor costs vary, though, on an individual basis and according to setting characteristics. Costs are disproportionately high in backcountry or wilderness settings, which are managed for primitive recreation experiences. Under such conditions, direct management actions are generally seen as inappropriate.

Costs to management

Moderate. Barriers require construction and maintenance, which can be expensive. Enforcement costs will vary, but depending on the rate of visitor compliance and the seriousness of the impacts involved, enforcement efforts may be substantial.

Effectiveness

Barrier effectiveness is highly variable. Barriers tend be effective at moving people efficiently through a site, whereas they may be relatively ineffective at blocking or hindering visitor access to an area or preventing off-trail travel. Barrier effectiveness may be significantly enhanced when used in combination with targeted visitor education efforts.

Barriers are likely to be effective if they convey a behavioral message to visitors whether or not they physically obstruct visitor movement. For example, a two-foot high polypropylene rope alerts visitors to management intentions and may activate visitor norms regarding compliance. Swearingen and Johnson (1994) found that yellow polypropylene ropes were, on the average, more than twice as effective as split rail fences in preventing off-trail travel. Compared to a no barrier control, the rope and split-rail fence reduced off-trail travel significantly.

The use of a scree wall, with rock cairns, paint marks and educational signs, was effective in keeping hikers in a New Hampshire alpine area on a well-defined treadway, which greatly reduced soil and vegetative impacts from off-trail travel (Doucette and Kimball 1990).

Fences were used at three barrier beaches in Massachusetts to protect sensitive piping plover nesting sites from human disturbance. The fences were successful in safeguarding the nesting and habitat requirements of the piping plover (Deblinger et al. 1989).

Selected references

Cole et al. 1987; Deblinger et al. 1989; Doucette and Kimball 1990; Hendee et al. 1990; Hultsman et al. 1987; Johnson and Swearingen 1992; McCool and Christensen 1996; Swearingen and Johnson 1994.

Increase (decrease), improve (not improve), or eliminate facilities

Purpose

This management tactic may be used to make access to an area easier or more difficult, thus redistributing use. Similarly, it may be used to control the means of access. Through use of this tactic, managers may selectively modify facilities and/or other park features to encourage or discourage certain types of use, or to alter the recreational opportunities the park provides. This tactic also has a significant resource protective function.

Description

Increasing or decreasing the number of, improving, not improving, or eliminating facilities may address the underlying cause of a problem or may serve as a secondary measure to support another tactic which addresses the cause of a problem. For example, if increased visitation is forcing visitors to "overflow" existing (narrow) trails, improving the trail by widening it addresses part of the cause of the problem. It does not specifically address another cause of the problem, too many people in the area. If managers decided to encourage visitation of an alternate area, this tactic would address too many people in a specific area.

Facility modification may operate directly or indirectly. For example, if increased visitation is occurring in a specific park area and managers cease to maintain trails leading to this area to discourage visitor access, this is an indirect management tactic. It does not control visitor behavior directly by limiting the number of visitors or restricting visitor access. Rather it tries to decrease visitation by making access less convenient.

This management tactic may function directly through adding or eliminating facilities. Expanding parking lots, adding additional trails, providing more restrooms, or building a new visitor center—or eliminating any of the above—directly influences visitor behavior while also changing the character of use within the park. This tactic, because of its infrastructure development component, has great potential to alter both natural conditions and the recreational experience opportunities an area provides.

Facility modification may be either subtle or obtrusive. Perceptions regarding where a given tactic lies along the subtle-obtrusive continuum is person specific. Some visitors may regard deteriorating trails as a sign of neglect and mismanagement, while others may view the same trail as a much sought after opportunity to get off the beaten track. Similarly, some visitors may regard mandatory use of a visitor transportation system (VTS) as both a transportation convenience and an ideal mechanism for protecting park resources. Others may chafe under the imposed restrictions to their

freedom and the enforced close proximity to large numbers of other visitors. In general, the removal of facilities is less obtrusive than adding facilities. Many visitors to a park will not know that a particular facility and associated recreational opportunity existed so will not miss it.

Even though newly constructed facilities are obtrusive, they may be welcomed and appreciated by large numbers of visitors. In this case, consideration of the subtleness versus obtrusiveness of the specific management action is not the sole criterion in management decision making; rather, all decisions should facilitate realizing the desired resource and social conditions for an area.

This management tactic can be effectively implemented through the formation of public-private partnerships. Since infrastructure development is costly, both in terms of construction and operation, the benefits of public-private partnerships include being able to provide more visitor services without relying on budget allocations from central offices. Several national parks (e.g., Denali, Yellowstone, Yosemite, Grand Canyon) have successfully contracted the building and maintenance of VTSs to private enterprises. The President's Commission on Americans Outdoors outlines a series of recommendations for boosting public-private partnerships in the management of public lands (Rogers 1987). The report suggests that public land managing agencies seek out opportunities to cooperate with private enterprises in the provision of visitor services.

Costs to visitors

Low to High. Specific management actions associated with increasing or decreasing the number of, improving, not improving, or eliminating facilities affect visitors differently. A single action may represent a low cost to one visitor but a high cost to another based on the type of recreational experience each is seeking. In assessing potential costs to visitors, consider the level of visitor freedom retained, and the extent to which an action, which may not be in keeping with individual preferences, is perceived by a majority of visitors to preserve acceptable biophysical, social, and managerial conditions. Targeted visitor education efforts which explain the purpose and/or need for modifying facilities, may help keep costs to visitors relatively low.

Costs to management

Low to High. Removing infrastructure is somewhat costly, although cost is usually not the decisive factor in decisions regarding whether to remove facilities. Many managers and planners have commented that it is “hard to go back.” Once a facility exists, removing that facility is very hard because of adverse public reaction. Increasing the number of or improving facilities

tends to be a costly management action. Often the cost is prohibitive, precluding many improvements that would otherwise greatly enhance visitor experiences. In addition to financial costs, the greater the number of facilities, the greater the amount of staff time and financial resources that must be allocated for staffing and maintenance.

Effectiveness

Effectiveness of this tactic often requires built in tradeoffs. That is, facilities in one area are eliminated or allowed to fall into disrepair while facilities in an alternative area are improved or expanded.

Facility modifications (increasing or decreasing the number of, improving, not improving, or eliminating facilities) must generate enough change in existing conditions to alleviate or substantially reduce unacceptable impacts. Small, incremental changes are unlikely to be effective when it comes to impacts to facilities. In addition, facility modifications often require appropriate rationing and allocation, regulations, deterrence and enforcement, and visitor education tactics to ensure effectiveness.

In their survey of NPS backcountry managers, Marion et al. (1993) found that 12 percent of parks surveyed had eliminated facilities in high-use backcountry attraction areas. Another 30 percent added or improved facilities in alternative areas. In addition, 18 percent of park managers reduced trail maintenance and 12 percent reduced road maintenance in or adjacent to backcountry areas to make access more difficult.

As a result of an impact analysis of three barrier beaches in Massachusetts, elevated boardwalks and a vehicle ramp were constructed at the beaches to reduce erosion. Subsequent monitoring indicated these facility modifications had significantly reduced unacceptable beach impacts.

Trails in a New Hampshire alpine region were improved by adding low-lying scree walls to both sides of a ridge trail (Doucette and Kimball 1990). Observed trail improvements included the regeneration of alpine vegetation that bordered the trail tread. In addition, 80 percent of hikers surveyed regarding the trail improvements felt that the scree walls were both unobtrusive and effective.

Selected references

Cole et al. 1987; Deblinger et al. 1989; Doucette and Kimball 1990; Manning et al. 1996; Marion et al. 1993; McLean and Johnson 1997; Rogers 1987.

Strengthen/harden sites

Purpose

Site strengthening or hardening increases site durability so that previous levels and types of visitor use may be sustained, or visitor use can be increased and/or diversified. Site strengthening and hardening ensures that impacts to resources are localized in a designated impact zone (adjoining areas are not protected).

Description

Site strengthening techniques include using soil cement, water bars, or steps on trails; watering, fertilizing, or planting resistant turf grasses; or opening up the tree canopy to encourage growth of resistant grasses on campsites (Cole et al. 1987). Use of asphalt, crushed rock or corduroy on trails or parking areas; bridges, boardwalks, or turnpikes; tent platforms at campsites; and permanent firegrates or cooking rings are all examples of site hardening techniques.

This tactic addresses one cause of unacceptable soil and vegetative impacts, namely, the recreational use of trails, campsites and other facilities. If a facility cannot be relocated to a site with more favorable soil, vegetation, and topographical conditions, then site strengthening or hardening is an alternative that reduces the extent to which visitor use can lead to unacceptable resource impacts.

Site strengthening or hardening is both a direct and indirect management action. Structures constructed in site strengthening or hardening efforts, including bridges, boardwalks, paved trails or parking areas, tent platforms or cooking rings, directly influence visitor behavior by providing ease of access, movement or operations. These techniques, however, may also function indirectly. For example, if visitors encounter a muddy spot on a trail, they will likely go around the spot leading to trail widening or an altogether new trail surface. When the muddy area has been hardened by using corduroy or a bridge or boardwalk has been constructed over it, the visitor is likely to remain on the designated trail.

Site strengthening or hardening may be either subtle or obtrusive. Visitors are likely to be aware of the site strengthening and hardening techniques that lead to changes in the structural design of facilities. Other techniques, such as those that facilitate the development of resistant vegetation, are subtle and may go unnoticed.

Costs to visitors

Low to High. Obtrusive structures detract from the natural appearance of an area, and frequently function to decrease visitor freedom as well. At the

same time, many of these techniques contribute to visitor convenience, which leads to high levels of visitor acceptance of trail improvements. Visitor preferences vary and the cost that accrues to a given individual depends upon the extent to which the conditions encountered match their desired recreation environment. Costs must be weighed against anticipated benefits and area objectives. Decisions regarding which site strengthening or hardening techniques to use must be based upon the biophysical, social, and managerial conditions for which the area is managed.

Costs to management

Low to High. Several site strengthening techniques are relatively inexpensive, although cost depends on the size of the area to be strengthened. Site hardening techniques, however, tend to be more costly. Preventive management actions, taken before conditions on a site deteriorate, are less costly than remedial actions, which are taken to reverse unacceptable resource conditions.

Effectiveness

Management actions to increase the durability of a site through the use of site strengthening or hardening are some of the most effective means to prevent unacceptable visitor-caused impacts to resource conditions. Although trail relocation may be preferable if large stretches of a trail cross unsuitable soil, vegetation, or terrain, the use of bridges (or boardwalks) and water bars are effective means of dealing with dispersed muddy patches and trail erosion, respectively. The amount of protection is limited, though, that site strengthening or hardening techniques provide. High levels of visitor use affect effectiveness, because the probability of visitors spilling over into nonstrengthened or nonhardened areas increases.

Site regeneration efforts at a heavily used alpine campground in Idaho included the hardening (i.e., surfacing with asphalt, gravel and other materials) of roads, trails, parking spurs, and areas around picnic tables and tent pads (Beardsley et al. 1974). Hardening was deemed necessary because of the sensitive nature of the native alpine vegetation. Beardsley et al. (1974) highlight that a corresponding visitor education program, explaining the reasons the site modifications were necessary and the time table for completion of the project, greatly enhanced visitor acceptance of the use of this management tactic.

Selected references

Beardsley et al. 1974; Chavez 1996a,b; Cole 1987; Cole et al. 1987; Stankey and Schreyer 1987.

Remove litter and other problems

Purpose

The purpose of removing litter and other problems is to remove the source of unacceptable impacts to resources and visitor experiences, to prevent further impacts from occurring, and to maintain acceptable biophysical, social, and managerial conditions.

Description

This tactic includes the removal of litter, human body waste, exotic plants and animals, animal remains and unauthorized facilities or structures. This tactic does not directly address the cause underlying why these undesired items are present. This tactic must be frequently used, but should generally not be used in isolation. Typically, this tactic should be used with a relevant visitor education tactic.

Removing litter or other problems is an indirect management tactic. For example, research and management experience has shown that if visitors see litter lying around, they are much more likely to litter. If visitors see evidence of off-road vehicular use—tire tracks leading off an established roadway—they are more likely to follow suit and drive their vehicle off the road. To the extent that managers can remove these potential behavioral triggers, they can alter visitor behavior.

Removing litter or other problems is a subtle management tactic. Visitors are unlikely to be aware that litter, human body waste, exotic plants or animals, animal remains or unauthorized facilities or structures have been removed unless they have used the area before and can detect the difference. Removal of exotics may be less subtle than the other uses of this tactic, because frequently such actions are undertaken in conjunction with a public awareness campaign, boat inspections, etc. Examples of such campaigns would be efforts to contain and/or eliminate zebra mussels and Eurasian milfoil.

Costs to visitors

Low to None. For the most part, this management tactic enhances visitor experience by presenting visitors with a recreational setting that managers have maintained in its natural state. Implementing this tactic may cause some visitor inconvenience. For example, shelters in semiprimitive areas may be removed if they attract large groups who engage in drinking alcohol and rowdy behavior. Other groups who travel to the area to enjoy dispersed recreation experiences may be inconvenienced by the removal of the shelter. But, these groups will be well served because, in this case, removal of structures leads to fewer large, unruly groups in the area.

Costs to management

Moderate to High. Management routinely invests a large amount of time and resources to maintain park grounds and preserve their natural appearance. Actual costs and time required depend upon several factors, including what type of material must be removed, how much material must be removed, how accessible the problems requiring removal are, and the extent to which this activity is incorporated into routine management activities. Costs to managers can be significantly reduced if successful visitor education efforts are conducted that emphasize minimum impact techniques, resource-friendly behavior, and consideration for other visitors' experiences. Other site management tactics also come into play, such as "increase (decrease), improve (not improve), or eliminate facilities."

Efffectiveness

This tactic can be highly effective at eliminating identifiable problems and preventing future occurrences of the problem. Effectiveness is enhanced when this tactic is used in conjunction with other site management, deterrence and enforcement, and visitor education tactics. Deterrence and enforcement efforts may be crucial, especially if the problem has assumed large proportions, or if there is recurring noncompliance by some visitors.

Managers at many national park areas routinely dismantle cairns visitors erect to mark primitive trails. The markers are viewed as incompatible with the qualities for which the backcountry area is managed. In addition, the removal of cairns is an indirect way to limit the amount of use an area receives since some visitors will be less likely to venture into the backcountry without the assistance of the cairns. Thus, the cairn removal policy protects the backcountry while ensuring, to some extent, that the number of visitors is kept within acceptable levels.

At Arches National Park, managers brush away tire-tracks of vehicles that lead off the designated roadway. They find that this practice is effective in discouraging other vehicles from using unauthorized travel routes.

Selected references

Christensen et al. 1992; Cole et al. 1987; Vande Kamp et al. 1994a,b.

Close areas or facilities

Purpose

Area or facility closures protect sensitive resource areas, especially critical wildlife habitat or cultural resources, while redistributing visitor use to alternative areas. In addition, area closures may be used as part of a rehabilitation scheme for an area that has suffered unacceptable impacts to resource conditions.

Description

Area or facility closures may be temporary, based on seasonal conditions or visitor use patterns, or permanent. Closures do not focus directly on the cause of resource or visitor experience impacts. For example, an area with significant cultural resources may experience problems with vandalism. Managers may therefore decide to close the area to visitor use to protect cultural artifacts. Closing the area, though, does not directly address vandalism, which is the problem.

Closing an area or facility is a direct management tactic. Once an area or facility is closed, visitors no longer have a choice about whether to use that area or facility.

An area or facility closure may be subtle or obtrusive, depending upon the visual cues present and visitors' previous experiences. If a closed area or facility is surrounded by gates, fences and/or threatening signs, visitors are likely to find such a closure highly obtrusive. On the other hand, many areas that are off-limits to visitors may be so far removed from normal traffic patterns that visitors remain unaware of the closure. In addition, those with previous experience in an area are likely to find the closure of that area more obtrusive than those lacking previous experience.

Area or facility closures, such as campsite closures, that are part of a rest-rotation system are unlikely to achieve desired levels of site restoration due to short impact periods (1 to 2 years under light use) and much longer site regeneration time requirements (from 3 to 20 years) (Cole 1981; Hammit and Cole 1998). Unless use at closed facilities can be permanently halted, impacts are likely to resume after the initial closure. Further, site closures are likely to be ineffective at reducing overall impacts to resources unless more durable sites are located nearby.

Costs to visitors

Low to High. Costs to visitors result from the loss of freedom associated with an area or facility closure, as well as costs derived from not being able to experience the unique features an area has to offer. Costs tend to be high if the closure is marked by highly obtrusive visual cues, or if visitors cannot

visit sought after attractions. If areas or facilities are closed to protect wildlife habitat or cultural resources, costs to visitors can be minimized by educating visitors about the need for such actions. Further, temporary closures impose a lower cost on visitors than do permanent closures, especially when the need for such closures is readily apparent, such as to protect nesting habitat during breeding season.

Costs to management

Low to Moderate. Management costs include the expense of signs and barriers, if used, as well as staff time and salary for enforcement efforts.

Effectiveness

Effectiveness is measured by how well the area or facility closure is adhered to by the public, and the extent to which the objectives prompting the closure are met (e.g., site regeneration, wildlife or cultural resource protection). If visitors are unaware of the closure, or if they purposefully disregard management directives, effectiveness is compromised. Effectiveness may be augmented by a suitable visitor education program.

Area or facility closures are more likely to be effective when applied to impacts to resources rather than impacts to visitor experiences. Closing an area to use allows the impacted resource to recover, but shifts visitor use to other areas.

Area or facility closures do not directly address the cause of visitor use problems. If increased visitation in an area (perhaps coupled with inappropriate visitor behavior or a management plan that fails to resolve unacceptable impacts) results in an inability to maintain acceptable resource and visitor experience conditions, closing the area is effective only as long as the area closure remains in effect. As soon as the area is reopened to visitors, similar impacts to resource conditions may occur unless other aspects of the management setting and visitor experience have been altered, and the causes of the impacts have been addressed. In this instance, the use of an area closure may simply buy managers the time needed to develop a more viable management plan.

As the result of an impact study and visitor survey, sensitive piping plover nesting sites were closed on three barrier beaches in Massachusetts (Deblinger et al. 1989). The nest sites were closed seasonally, and additional protection from predation was provided by using protective fencing. These closures were supported by the majority of visitors surveyed.

In a survey of NPS backcountry managers, Marion et al. (1993) found that 46 percent of parks had closed environmentally sensitive backcountry areas to all visitor use. In addition, 13 percent of the parks closed trails to make access to backcountry areas more difficult and another 31 percent closed roads to discourage access. Thirty-seven percent of the parks closed or rehabilitated backcountry campsites in which resource conditions had deteriorated; 37 percent closed unwanted backcountry campsites.

Selected references

Beardsley et al. 1974; Cole 1981; Cole et al. 1987; Cole et al. 1997b; Cole and Ranz 1983; Deblinger et al. 1989; Frost and McCool 1988; Gale 1985; Gale and Jacobs 1987; Hammit and Cole 1998; Higgins 1992; Lee 1991; Manning et al. 1996; Marion et al. 1993; Marion and Sober 1987; McCool and Christensen 1996; McLean and Johnson 1997; Stohgren and Parsons 1986; Sullivan 1984.

Rationing and Allocation

limit access using reservations

limit access using a first-come first-serve (queuing) system

limit access using lotteries

limit access using merit/ eligiblity system

charge fees

Rationing and Allocation

Rationing regulates use intensity by limiting use of an area. Allocation apportions limited use and resources among competing groups, for example, between the commercial and the private sector, and it refers to how use limits are accomplished. Rationing and allocation are highly integrated with one another. Unless a rationing system is in place, allocation between groups cannot occur. Similarly, once the decision has been made to restrict use via one of several rationing tactics, the question of allocation will almost certainly arise.

Rationing

Most resource and visitor experience impacts are concentrated at specific sites. Rationing tactics address the cause of the problem only if they address localized visitor use problems. Area-wide use limits have the potential of controlling biophysical and social impacts associated with increased use. But, since decreasing the number of visitors area-wide frequently does little to alter overall use patterns, this potential often goes unrealized. Furthermore, use limits generally are a direct management tactic in that they act directly upon visitor behavior as it pertains to visitation. To the extent that the costs (time, effort, money) to visitors associated with these tactics influence decisions made about whether to visit, these tactics may function indirectly as well.

Rationing tactics are fairly direct and obtrusive. However, they differ in terms of their relative obtrusiveness and their effects upon visitor experiences. Visitors may become aware of a rationing tactic's obtrusiveness during the planning stage of their visit, at the time of their visit, or not at all. For example, if differential pricing is used to limit use, visitors are aware of the fees they pay, although they may not be aware of the management strategy underlying such fees. Since visitors usually have an opportunity to plan ahead when reservations are issued, negative impacts on visitor experience tend to be diminished. Visitors who curtail spontaneous trips because of advanced planning constraints, visitors who are denied access, and visitors who face long waits at the station where they must pick up their reserved permit often experience decreased visitor enjoyment. But, to the extent that using these tactics keeps crowding within acceptable levels, visitor experience can be greatly enhanced.

Of all the management tactics available to managers, rationing and allocation have perhaps generated the most controversy, both within scholarly writing and the public arena (e.g., Stankey and Baden 1977; Cole 1995). With rationing, how use limits are implemented is frequently at the center of controversy. In addition, the question of equity arises whenever use is limited via pricing or merit-based application. Those who insist that public lands should be equally accessible to all socioeconomic groups,

express concern that those with low income levels lack the financial resources to pay entrance fees or obtain specialized training.

Public involvement in the process leading up to implementing of use limits can be a positive factor in whether use limits become an accepted part of the management plan for a given area. In general, acceptance of use limits increases when stakeholders and the public understand that maintaining acceptable biophysical or social conditions depends upon implementing use limits (Cole et al. 1987; McCool and Christensen 1993). Shelby et al. (1982) summarize the results of studies exploring visitor attitudes toward use limits. In several studies, most visitors supported use limits to reduce crowding and protect resources (Stankey 1980a,b; Shelby et al. 1992; Anderson and Manfredo 1986). Furthermore, support for limiting use remained high even among visitors who were denied access to two different backcountry areas (Fazio and Gilbert 1974; Stankey 1979). Shelby et al. (1982) conclude that visitors generally support management actions which contribute to quality visitor experiences.

Instituting use limits is a drastic measure that should only be used as a last resort, after other options have been fully exhausted. Behan (1974), in a discussion about trails in the Grand Canyon wilderness, suggests "If the facilities are crowded, but the land is not, then the sensible response to 'overuse' is clear: simply build more facilities. Only if the land is crowded, if the wilderness opportunities are fully developed, should wilderness rationing be adopted at all" (p. 23).

When considering rationing, it is important to recognize that the crowding problems result from both supply and demand-related issues. Too often, managers assume that the supply of recreation opportunities is a "fixed" quantity, and that increased demand necessitates the implementation of use limits. The supply of facilities or opportunities to access an area, however, may be increased to accommodate additional demand.

Rationing is not a panacea to solving problems associated with visitor crowding. In some cases it creates unwelcome managerial constraints. But, rationing can, fulfill an important role in a comprehensive management plan to address visitor use problems. Careful analysis of site-specific factors, as well as broader issues associated with rationing, is an important early step in considering how it may be best adapted to meet the needs of a given area.

Allocation

Allocation refers to how use limits are apportioned among groups of visitors or competing interests, such as between commercially outfitted and privately outfitted river trips, between hikers and horseback riders, between day-use visitors and campers, and between backcountry visitors on short stays and long stays.

Allocation of limited use between commercial and private groups has traditionally occurred in backcountry and river management situations. However, in recent years allocation of use has become increasingly important in frontcountry areas as well. As day use of popular parks and frontcountry attraction sites increases, managers increasingly are considering day-use permit systems. Under such circumstances, tour groups may vie with private groups to gain access to frontcountry areas. This action forces managers to decide how many tour buses versus private vehicles, or alternately, how many tour participants versus private individuals, to allow to have access to popular sites (e.g., Lime et al. 1995).

Allocation between commercial and private sector groups may be split or nonsplit (Buist 1981; Cruz and Jiron 1994). If allocation is nonsplit, then individuals within the commercial and private sector compete equally for limited use of an area. These first-come first-serve systems are popular in many backcountry areas, such as Minnesota's Boundary Waters Canoe Area Wilderness.

If allocation is split, members of a particular user group (e.g., commercial or private sector) do not compete equally for limited use of an area. Instead, managers establish a ratio delineating what proportion of use opportunities are allotted to each sector. The split may be down the middle, resulting in an even split. This 50/50 ratio ensures that if all the use opportunities are allocated, each sector will account for exactly half the area's total use. A variation of the even-split method is the even-pool method. Under this condition, use is initially allocated on an even-split basis, but after a time, use opportunities that remain available are allocated to members of each sector on a first-come first-serve basis.

An interesting commercial sector/private sector split ratio is 0/100. Such a ratio provides for 100 percent of the use opportunities to be allocated to individuals in the private sector. These individuals then have the option of signing up with a commercial provider if they choose. Cruz and Jiron (1994) suggest this method has the advantage of ensuring that only those who truly desire commercial services will use such services. The major disadvantage of this method is the resulting uncertainty for commercial enterprises. Since it is difficult for commercial groups to predict accurately

the number of individuals who will enlist their services, services offered might fluctuate or decline.

However, if 100 percent of the use opportunities are channeled through the commercial sector, a 100/0 commercial sector/private sector ratio, the impacts upon private individuals will be substantial. An example of a situation in which the commercial sector had a virtual corner on the market is the Colorado River of the Grand Canyon. From 1972 to 1979, the commercial/private sector allocation ratio was 92/8. In 1979, the NPS adjusted the allocation ratio to 70/30. This adjustment was accomplished by increasing private sector use of the river, especially during the off-season, *not* by decreasing use opportunities allocated to the commercial sector (Cole 1989a). As a result, individuals who wish to obtain a permit to float the Colorado River must wait at least six years for their names to reach the top of the waiting list, whereas, those who sign up with commercial outfitters can expect to go within one or two months. Although such skewed split ratios may be the result of a conscious management decision to favor one group over another, frequently they are "inherited" by managers as a result of historical use. Of all the possible factors upon which use allocation decisions could be based, the most frequently used criterion is historical use (Buist 1981).

Five rationing and allocation tactics discussed in this section are:

- limit access using reservations
- limit access using a first-come first-serve (queuing) system
- limit access using lotteries
- limit access using merit/eligibility system
- charge fees

Limit access using reservations

Purpose

A reservation system controls the intensity of visitor use by limiting the amount of use in an area. Furthermore, depending upon the system in place, a reservation system redistributes use to follow acceptable use patterns. Reservations also provide a potentially equitable way to distribute recreational opportunities among all interested parties.

Description

A reservation system requires visitors to plan ahead to obtain a permit to visit desired recreational sites or attractions. Advance reservation is one of several ways in which permits may be distributed. Other methods include queuing (or first-come first-serve), lotteries, eligibility requirements, and fees. To qualify as a rationing strategy, permits must be mandatory rather than voluntary, and the supply must be limited. (Voluntary permits assist managers in gathering demographic information about visitors and travel patterns, but they do not facilitate controlling visitor use intensity.)

Reservations may address the cause of the problem or may be used in conjunction with other tactics that address the cause of the problem. To the extent that a reservation system is implemented to alleviate crowding and related impacts to visitor experiences, they address a problem's cause. A reservation system can address the causes of these impacts directly. That is, if there are too many people, reducing the total number of individuals allowed to enter an area is a management tactic that has the potential to eliminate crowding. However, because it is usually not the total number of recreationists that poses the problem, but rather their distribution patterns or their behavior, simply limiting the number of individuals allowed to access an area may not alleviate unacceptable impacts. In this case, a reservation system would function in conjunction with a management tactic designed to address the cause of the unacceptable impact.

Implementing a reservation system is primarily a direct management tactic. If a visitor permit is obtained, the permit frequently dictates where the visitor goes, on what date, and at what time. Some visitors find that the advance planning required to obtain permits, cuts into the spontaneity of their park visits. In such cases, they may decide to forego an application process that they perceive to be a burden. In addition, they may believe that they are "locked in" to a specific itinerary or destination, which can detract from their overall recreational experience. In this way, a reservation system can act indirectly to discourage would-be visitors from visiting the park. Although this tactic may contribute to meeting the management objective of reducing visitor use, those who decide not to go through the reservation process for these reasons do not comprise a random cross-

section of all those not attending. Thus, the implementation of a rationing system may result in the displacement of visitors who value spontaneity and unconfined recreation.

Reservation systems are an obtrusive management tactic because visitors tend to be aware that the system is in place and of its requirements. However, once a visitor obtains a permit and enters an area, there may be no, or very few, visual cues that remind the visitor that rationing is in place. As a result, implementing a permit system may enhance the visitor experience because it reduces crowding and because it may amke other tactics such as signs, barriers, uniformed personnel, and regulations unnecessary. Even though permits can enhance visitor experiences, for some visitors permits may result in a sense of being confined and inconvenienced.

Costs to visitors

Moderate to High. The advance planning required, which takes time and limits spontaneity, the possibility of not obtaining a permit or not being able to visit the desired location, and the processing fee frequently charged to cover the expense of operating a reservation system, all constitute costs to visitors.

Costs to management

Moderate to High. Management costs include the staff time required to operate a reservation system and to enforce it. The burden on staff time can be substantially reduced if the task of actually booking reservations is subcontracted to a commercial company.

Effectiveness

Reservation systems have generally proven effective at controlling the intensity of visitor use in terms of overall numbers of visitors within an area at a given time. They are typically less effective at controlling intensity of use at key attraction sites. Even with a reservation system in place, additional measures will often be required to ensure that crowding does not remain a problem at these locations. A reservation system is often most effective when it is combined with some other method of rationing use, such as queuing. This dual approach to issuing permits builds flexibility into the system, and when used in conjunction with queuing, provides recreation opportunities for those who plan their trip at the last minute.

A 1994 report on day-use reservation systems for Yosemite National Park, identified 12 factors regarding how to successfully develop, implement, and operate a day-use reservation system (table 4). The report's recommendations apply equally well for overnight reservation systems.

Table 4. Factors to consider in the development, implementation, and operation of a reservation system.

• Low reservation fees and a no-refund policy tend to lead to a large number of no-shows.
• Visitor survey data (i.e., fluctuation in visitation temporally and average length of stay) and detailed visitor observation studies (i.e., traffic flow) are necessary to define system parameters.
• Overbookings can work in a mature system. This signifies that no-shows have been properly accounted for.
• Flexibility and periodic reevaluations should be built into the contract whenever reservation systems are out-sourced.
• Cancellation policy/fees should be set by the park, not the reservation system vendor.
• Reservation systems should accommodate customers who wish to pay by either credit card or cash.
• Phased admissions can be very effective in managing congestion.
• Carrying capacity limits, if used, must specify whether they are for total capacity at any one time, or totals for a given period (e.g., one day).
• Reservation systems can be successfully developed in-house, but require a large number of personnel.
• Reservations can be established on a per person or a per vehicle basis. (e.g., Grand Canyon South Rim may go with a per vehicle system whereas the North Rim may go with a per person system).
• Develop clear communication standards with vendor to prevent problems with information flows.
• A joint reservation system among several parks provides for economy of scale in operations.

Source: USDI, NPS (1994).

Reservations are required in a large number of NPS-administered parks, recreation areas, wild and scenic rivers, national monuments and national historic sites. For example, Grand Canyon National Park issues more than 15,000 overnight backpacking permits per year. Visitors must apply several months ahead of time to secure a permit. Campsite reservations at the Grand Canyon are generally booked eight weeks in advance. In addition, more than 20,000 rafting permits are issued annually for the Colorado River to commercial and private users.

In their survey of NPS backcountry managers, Marion et al. (1993) found that 68 percent of parks required overnight permits and 8 percent of parks required day-use permits for their backcountry areas. In about two-thirds of the parks, permits were only required for certain activities ranging from overnight backpacking (63 percent), to river use (8 percent), caving (10

percent), diving (6 percent), horse use (4 percent), hang gliding (4 percent), and hunting (4 percent). Of these, 58 percent used the reservation system to reduce use. Issuing permits was most often accomplished via queuing, with the second most common method being a combination of advance reservation and queuing. Reservations were seldom the means of issuing permits, and lotteries were never used alone. Only 5 percent of the parks charged a fee for visitors to obtain a backcountry permit. In 68 percent of the parks where permits were issued, visitors could only obtain permits in person. In 18 percent of the parks, visitors could obtain permits by telephone, mail or in-person.

Selected references

Brown and McConnell 1978; Cole et al. 1987; Cruz and Jiron 1994; Driver and Brown 1978; Glass and More 1992; Hendee, Stankey and Lucas n.d.; Manning et al. 1996; Marion et al. 1993; McCool and Christensen 1996; Shelby et al. 1982; Shelby and Heberlein 1986; Shinder and Shelby 1993; Stankey 1979; Stankey and Baden 1977; USDA, NPS 1994; Utter 1981; Watson and Niccolocci 1995; Wilke 1991.

Limit access using a first-come first-serve (queuing) system

Purpose

Queuing controls the intensity of visitor use by limiting the amount of use of an area and, depending upon the system in place, by redistributing that use to follow acceptable use patterns. Queuing also provides an equitable way to distribute recreational opportunities among interested parties.

Description

Queuing requires visitors to obtain a permit on a first-come first-serve basis.

Queuing is a management tactic that may be used alone to address a problem or used in conjunction with other tactics that address the cause of a problem. Like other rationing tactics, queuing may be implemented to alleviate crowding, visitor conflicts, and other related impacts to visitor experiences. To the extent that limiting the total number of people in an area is successful in reducing these impacts, it addresses the cause of the problem. However, it is not always the total number of individuals in an area that cause crowding and related impacts. Rather, it is the spatial distribution of visitor use that sometimes leads to these impacts. Thus, if queuing is implemented as a management tactic, without corresponding attention being paid to alleviating crowding at trouble spots, it may not reduce impacts. Queuing is best used with other management tactics that address the cause of unacceptable impacts.

Queuing is primarily a direct management tactic. Only those who wait can obtain a permit, therefore, a powerful management influence is exerted on visitor behavior. In conditions where permits are scarce relative to demand, queuing can have a strong indirect influence on visitor behavior. In such cases visitors may conclude that it is not worth the time and effort to wait for a permit they may not obtain. Another indirect influence is the extent that a first-come first-serve policy encourages spontaneity in trip planning. Individuals who might be displaced under an exclusively advance reservation-based system, have an increased opportunity to pursue spur of the moment visits under a queuing-based system.

Like other rationing tactics, queuing is an obtrusive management tactic that places noticeable demands upon visitors. However, unlike reservation systems, these demands may be more time consuming and may not be able to be met while the visitor is offsite. In addition, if visitors arrive at their desired recreation area only to find they cannot obtain a permit, the costs to visitors and probably the perceived obtrusiveness of queuing increases. Yet, those who obtain a permit, and then proceed to engage in their desired

recreation experience, are likely to find no further intrusion from this tactic on their experience. Thus, with regards to the onsite experience, queuing may be viewed as a subtle management tactic.

Costs to visitors

Moderate to High. Costs to visitors include the amount of time required to obtain a permit, as well as the potential frustration and the lost recreation opportunities resulting from failure to obtain a permit. Costs to visitors increase when the supply of permits is scarce relative to demand. Visitors must arrive early and wait in line longer to obtain their permit, and simultaneously, the probability of failure increases substantially. In addition, since many national parks are far from major population centers, potential visitors may plan for months and then travel long distances to visit specific national parks. Therefore, the inability to visit a specific park or scenic attraction can negatively impact their whole vacation experience. Even so, visitor surveys conducted among those who unsuccessfully waited in line for a backcountry permit still revealed strong support for this method of limiting use.

To minimize these costs, managers can do several things. First, they can devise a permit system that rations a portion of the permits by advance reservation and another portion on a first-come first-serve basis. Second, managers can direct visitors who are unsuccessful in obtaining a permit in one park to nearby parks or attractions that might provide similar recreation opportunities. Third, managers can inform prospective visitors of the rationale behind management efforts to limit use, as well as encourage them to return during off-peak times when the likelihood of successfully obtaining a permit is higher. Finally, managers can develop a waiting list. So, those who queue up unsuccessfully one day would be the first ones on the list the following day.

Costs to management

Moderate to High. Although the expenses required to issue a permit actually may be lower for a queuing system than a reservation system (e.g., due to the lack of telephone and mailing costs), there is the added expense of facilities and sometimes services for those waiting. In addition, the costs associated with staff time to administer and enforce the system may be substantial.

Effectiveness

Queuing is particularly effective at exhibits, historical buildings, caves, or other sites that lend themselves to guided or self-guided tours. In addition, queuing provides some opportunity for managers to adapt to current environmental conditions, such as excessive moisture in the areas listed

above, by temporarily adjusting the number of permits issued. This flexibility allows managers to protect resources during times when they are susceptible to impact. Queuing as the sole means of distributing permits, however, is likely to be less effective than queuing used in conjunction with some other rationing tactic. Providing several means by which visitors can obtain permits increases the range of visitors who will find the rationing system convenient and able to meet their needs.

An example of where queuing is successful is Arches National Park. Queuing is used to distribute permits for ranger-guided tours of the Fiery Furnace. Tickets are required to visit the Cliff Palace or Balcony House ruins at Mesa Verde National Park. Same day queuing is used to distribute these tickets, and no advance reservations are allowed.

Selected references

Cole et al. 1987; Glass and More 1992; McCool and Christensen 1996; McLean and Johnson 1997; Shelby et al. 1982; Shindler and Shelby 1993; Wikle 1991.

Limit access using lotteries

Purpose

Lotteries control the intensity of visitor use by limiting the amount of use of an area and, depending upon the system in place, by redistributing that use to follow acceptable use patterns. Lotteries also provide an equitable way to distribute recreational opportunities among interested parties.

Description

Like reservations, lotteries require individuals to plan ahead to obtain one of a limited number of permits. The use of a lottery is one of several ways that permits may be distributed including advance reservations, queuing, eligibility requirements, or fees. Lotteries have been successful in rationing hunting and fishing licenses, river rafting opportunities, and other recreational opportunities for which demand is significantly greater than supply. Lotteries may be designed to allow each applicant an equal probability of selection, or tailored to fit specific selection criteria such as giving a greater probability of success to state or local residents, or allowing previously unsuccessful applicants a greater probability of success than new or formerly successful applicants. In addition, lotteries are often specifically designed to accommodate group applications.

Like other rationing tactics, lotteries may address the cause of the problem or be used along with management tactics that directly address unacceptable impacts. When lotteries successfully eliminate impacts linked to total numbers of visitors or use distribution patterns, they are considered a primary management tactic. Frequently, however, lotteries, like other rationing tactics, are not used in such a way that they address unacceptable impacts to resources and visitor experiences at attraction sites or impacts resulting from traffic flow problems. In these cases, lotteries should be used with other management tactics that directly address the problem.

Lotteries are primarily a direct management tactic. To successfully obtain a permit successfully via a lottery, visitors must make sure they fit within selection criteria and submit a properly completed application. Since it is not uncommon to have thousands of applicants compete for a very limited number of permits, lotteries also may have a strong indirect influence on visitor behavior. Visitors who consider their chances of successfully obtaining a permit to be slim to none may not bother to apply.

Finally, like other rationing tactics, lotteries are an obtrusive management tactic, placing noticeable demands upon visitors. Like reservation systems, lotteries require advance planning, which may curtail opportunities for spontaneous recreation. The demands lotteries place upon the individual are met largely offsite. Permits obtained by lottery are usually mailed to the

individual or group leader with no further requirements to visit a permit pick up location. Thus, once the visitor is onsite and engaged in their desired activity, the use of lotteries as a rationing tactic has no negative impact upon their experience. In this way, lotteries may be considered a subtle management tactic in terms of the visitors' onsite experience.

Costs to visitors

Moderate to High. Costs to visitors include the loss of freedom to visit an area at will, as well as the time and effort required for the application process. Since demand for permits frequently far exceeds supply, a small percentage of applicants is successful in obtaining a permit. This dynamic undoubtedly has some negative impacts on visitors, and may explain why, in one study, visitors ranked lotteries behind reservations and queuing in terms of preferred rationing tactics (Wikle 1991). However, McCool and Utter (1981) reveal that 92 percent of those whose applications were rejected for peak season white water river trips on the Middle Fork of the Salmon River in Idaho still gave lotteries an acceptable rating as a rationing technique.

Costs to visitors may be minimized if the lottery has a procedure in place for allowing previously unsuccessful applicants an increased probability of success in future lotteries. Oftentimes, this increased probability can be cumulative so that by the tenth year, for example, the lottery applicant is almost assured of successfully obtaining a permit.

Costs to management

Moderate. Compared to other rationing tactics, costs to management may be less with lotteries because all applications can be received and permits issued in one step. The latter is particularly true when permits are issued for a limited period, as is the case with hunting and fishing permits issued based on seasonal fish runs, or the peak use season for a park or river. Thus, operating a lottery system may be less labor intensive than other rationing tactics in which applications are accepted year round.

Effectiveness

Lotteries are an effective tactic for rationing the use of an area. Traditionally they have been employed to distribute whitewater rafting, wilderness, or hunting permits. As a result, visitors are more likely to accept the use of lotteries for these types of activities than they may be for other recreational activities. Nonetheless, there is no reason to exclude lotteries from other activities and settings. An important source of visitor acceptance for lotteries stems from the perception that lotteries are unbiased and fair. Effectiveness can be greatly undermined if the lottery selection process is inherently biased or flawed.

McCool and Utter (1981) studied river recreationists who applied for permits issued by lottery to float the Middle Fork of the Salmon River, which flows through the River of No Return Wilderness in Idaho. Survey results showed that visitors were fairly satisfied with the lottery system. This level of satisfaction held even among those whose applications were rejected. The authors note, thought, that their sample did not include would-be river recreationists who were so opposed to the lottery and the accompanying "red tape" that they chose not to participate in the process. A major issue of concern among survey respondents was the way the lottery system was administered, highlighting the importance of effective implementation in ensuring visitor acceptance of this tactic.

Selected references

Glass and More 1992; McCool and Utter 1981; McLean and Johnson 1997; Shelby et al. 1982; Wikle 1991.

Limit access using merit/eligibility system

Purpose

Merit-based requirements control the intensity of visitor use by limiting the amount of use in an area and, depending upon the system in place, by redistributing use to follow desired use patterns. Eligibility requirements encourage self-selection with regards to willingness to meet selection criteria. However, if opportunities to meet criteria are limited or costly, eligibility requirements will be less equitable than reservations, queuing, or lotteries.

Description

The process of issuing a permit based on merit-based or eligibility requirements begins when an individual submits an application to visit an area or to engage in a specific activity within that area. Eligibility requirements are usually instituted for backcountry or wilderness areas, or areas with sensitive biophysical or cultural resources. To meet permit qualifications, the applicant must demonstrate specific skills, knowledge, or previous experience relevant to the area to be visited or the activity to be engaged in. A competency test or successfully completing a certification process may be required as part of the application process.

As a rationing tactic, merit-based or eligibility requirements can directly address the cause of a problem or be used with other tactics that directly address unacceptable impacts. Reducing use through issuing a limited number of permits, however, tends to solve only those visitor use problems that are the direct result of the total number of visitors. The primary purpose and benefit of a merit-based permit application process is that managers are able to eliminate unqualified recreationists (Shelby et al. 1982). Thus, its role in reducing use is secondary to its ability to ensure that visitors possess the prerequisite skills, knowledge, or previous experiences to use an area. Most crowding and visitor conflict-related problems are caused by crowding at specific attraction sites, traffic flow patterns, or group size, type of group, and behavior of other parties. Since limiting the total number of visitors usually fails to address these underlying causes, merit-based or eligibility requirements are most effective when used with other management tactics to redistribute visitor use and address other unacceptable resource impacts.

Merit-based or eligibility requirements are a direct management action. Visitors must not only go through an application process to obtain one of a limited number of permits, but they must also spend time, energy, and money to acquire the prerequisite skills, knowledge, or experience to use a specific area. It is this double burden on the visitor that leads to the tactic's indirect influence on visitor behavior.

Many visitors who accept the demands of obtaining a permit by reservation, queuing, or lottery, may not be motivated to fulfill specific eligibility requirements. Thus, visitors must assess whether the value of the recreation opportunity is worth the time, effort, and money required to meet the selection criteria. Shelby et al. (1982) argue that this double burden increases the social efficiency with which recreation opportunities are rationed. That is, those who value the experience more than others do are the ones who eventually obtain the right to participate. As with any rationing method, merit-based requirements may result in the displacement of a large number of visitors who share specific kinds of recreation preferences.

Merit-based or eligibility requirements are an obtrusive management tactic because they place noticeable demands upon visitors. However, these demands are met while the visitor is offsite. Once the requirements have been met and the visitor is onsite, visitor experience is no longer affected by this tactic. Thus, with respect to onsite experience, eligibility requirements may be considered a subtle management tactic.

Cole et al. (1987) maintain that merit-based or eligibility requirements are likely to be more useful as part of a program to modify character of use and reduce per capita impacts than to reduce overall use.

Costs to visitors

Moderate to High. Costs to visitors include a loss of freedom to pursue spontaneous outings as well as the time, effort and financial expense associated with meeting the selection criteria. Obviously, costs are not as high for visitors who already meet selection criteria and only need to document it on the application form or pass a proficiency test. Costs increase substantially when a visitor wants to visit the recreation area or engage in the recreation activity for which a permit is required, but is prevented from doing so by lack of funds or prerequisite training. Costs to visitors who obtain a permit are minimized because, in many cases, the onsite demands of this tactic are minimal. In addition, those who are successful in obtaining a permit are likely to enjoy a higher quality recreation experience because (1) the number of other visitors is limited and (2) other visitors in the area have appropriate (or similar) skills.

Costs to visitors can be minimized in one of two ways. First, to the extent that eligibility requirements are required for only certain areas within a park, a great deal of visitor choice and opportunity is retained. Second, the park might be able to provide, free of charge or for a nominal fee, the training required to meet selection criteria. This second option is more appropriate in cases where only basic skills and knowledge are required to meet

selection criteria. If, for example, diving certification or advanced rock climbing skills are required, the park may be limited in its ability to supply the prerequisite training.

Costs to management

Moderate to High. Generally, costs to management may not be as extensive as with the other rationing tactics. However, if managers require skills or training beyond some minimum level of competency, difficulties and even controversy can arise in deciding what makes a person "worthy" (Shelby et al. 1982). Management costs increase when required training is provided onsite. Efforts to document whether applicant claims regarding skills, knowledge, and experience are legitimate, and the enforcement of the eligibility requirement system will require additional staff time.

Effectiveness

As with other rationing tactics, eligibility requirements are more or less effective at alleviating visitor use problems depending on the degree to which the causes of the visitor use problems are addressed in system implementation. Cole et al. (1987) note that eligibility requirements will be effective only if skill, knowledge, and previous experience requirements are stringent enough to eliminate many potential visitors. Even then, more direct causes of visitor use problems than total number of visitors must be adequately addressed. In addition, visitors must see the need for the skill, knowledge or previous experience requirements to ensure visitor acceptance. Tactic effectiveness may be enhanced because more experienced users tend to be more aware of impacts to resources and visitor experiences and more supportive of management efforts to address such impacts. Thus, if eligibility requirements are instituted for problem areas, the resulting change in the knowledge and experience level of those who visit the area may be sufficient to reduce unacceptable impacts.

Eligibility requirements used with visitor education tactics may be an effective way to reduce unacceptable resource and visitor experience impacts. For example, minimum impact hiking and camping skills could be assessed by the park before permit issuance. Visitors who fail to pass the initial test or screening could be required to view an instructional video, for example, and then retake the test following the viewing of the video. Or, viweing the video could be required of all applicants, followed by a short quiz in which the visitor demonstrates knowledge mastery. In the Boundary Waters Canoe Area Wilderness, all camper parties must watch a short (7 minute) video concerning minimum impact practices before their wilderness permit is issued. However, currently no confirmation of their knowledge of the information presented is required.

Marion et al. (1993) conducted a survey of national park backcountry managers. Survey results indicated that 22 percent of national park backcountry areas require specific skills or equipment for specific uses.

Selected references

Cole et al. 1987; Hammit and Cole 1998; Manning et al. 1996; Marion et al. 1993; McLean and Johnson 1997; Schreyer 1977; Shelby et al. 1982; Wagar 1940.

Charge fees

Purpose

Charging fees can be used to control the intensity of visitor use by requiring visitors to pay a flat or differential fee to gain access to a specific park area or to an entire park. These fees serve a different purpose than fees designed to increase park revenue.

Description

Charging fees is a mechanism for rationing visitor use in which managers adjust the supply of recreation opportunities provided, the fee, or both, until supply equals demand (Shelby et al. 1982). Ethical and pragmatic arguments exist both for and against charging fees for the use of national parks and related areas (Lundgren 1996; Lime and Lewis 1997). Arguments against charging user fees relate to the extent that they are perceived to discriminate against the poor, which violates distributive justice principles. Arguments for user fees emphasize that the public should not be required to subsidize the recreational pursuits of a minority of visitors to recreation areas. Arguments in favor of charging fees as a rationing mechanism emphasize the latter.

Fees may be assessed based on a variety of factors including time of visit (e.g., peak season or off-peak season), destination (e.g., popular attraction site, frontcountry, backcountry, or special protected zone), level of facility development (e.g., visitor center), and type of use (e.g., guided tour, mountain climbing expedition). It is important to emphasize, however, that to qualify as a rationing tactic, fees must be charged with the objective of reducing and redistributing visitor use to solve specific, unacceptable impacts to resource conditions and/or visitor experiences, not to provide an additional source of park revenue.

To the extent that fee structures are set up in such a way that impacts such as crowding, congestion, and visitor conflicts are minimized, fees function to address the cause of unacceptable impacts. Since, fees, like other rationing tactics, frequently do not deal directly with the causes underlying visitor use problems (such as crowding at primary attraction sites, traffic flow patterns, and visitor behavior), they frequently operate best when used with other management tactics.

Charging fees is primarily an indirect management tactic in that it influences the decision factors affecting visitor behavior. Fees encourage visitors to set priorities and evaluate how much an experience is worth, that is, how much they are willing to pay to enjoy a specific type of recreation opportunity. Thus, only those who value the experience highly enough will be willing to pay the required price. However, to the extent that pricing

discriminates against people who are unable to pay, it is a management tactic with undesirable social ramifications.

Charging fees is an obtrusive management tactic since it is readily evident to visitors. Furthermore, since most fees are paid at an entrance point or deposit facility onsite, fees have a more pronounced effect on onsite visitor experience than some other rationing tactics. In addition, the notion that people pay attention to something when it hits them in the pocketbook, also suggests that fees may be more obtrusive than other rationing tactics. On the other hand, visitors may feel that they get what they pay for, and perceptions of quality may increase as a result of fees paid. If visitors are notified about how their fee dollars are used to benefit the park, they may feel good about having an opportunity to contribute to meaningful park management objectives. Finally, although fees are fairly obtrusive, management intent behind fee structure may not be evident to visitors. Visitors are accustomed to paying use fees that have nothing to do with reducing use. Managers may or may not wish to educate visitors as to the purpose behind an area's fee structure, or the way that use fees alleviate crowding-related impacts.

Costs to visitors

Moderate to High. Costs to visitors are primarily financial. However, visitors may resent the intrusion of market forces of supply and demand and "commodity" pricing into recreational opportunities that traditionally have been viewed as a government service provided for the benefit of its citizens. Cicchetti and Smith (1973) and Robinson (1975) point out that visitor demand for dispersed recreation opportunities is high enough that modest price increases will not lead to large decreases in use levels. Instead, large price increases will be necessary to keep visitor use within ecological, social or facility carrying capacity limits since user fees are such a small percentage of the total cost of recreational trips. Wetzel (1977), indicates that if charging fees is successful in reducing crowding, the net value of the recreational experience will increase with a price rise. Thus, Wetzel (1977) argues that maximum use value is not achieved with zero or very low prices. Instead, costs to visitors decrease when pricing or other rationing tactics are used to maximize per person use value.

Costs to management

Low to Moderate. Costs to management include the staff time required to administer fee collection and accounts, prevent access to those who are unwilling to pay, and address the concerns of those visitors who object to or are dismayed at the newly implemented fee structure. In addition, facilities to collect fees will have to be built if convenient structures do not already exist.

Effectiveness

The primary reason the effectiveness of charging fees is limited is that state or federal land managing agencies are typically reluctant to raise fees to the level required for supply to equal demand. However, fees may be effective in shifting visitation patterns to follow those desired by managers. For example, fees could be used to shift use from peak periods to off-peak periods. It is unclear, however, whether charging fees alone can successfully shift visitation from heavily used attraction sites such as Yosemite Valley, the Grand Canyon, or Old Faithful, to sites of secondary interest. In concluding his review of more than two decades of fees research, Cordell (1981) suggests: "A discriminatory pricing system where different market-clearing prices are charged at different areas for different recreational pursuits and where different prices are charged for peak and off-peak periods seems desirable and more efficient" (p. 102).

Selected references

Cole et al. 1987; Cordell 1981; Hanna and Dodge 1995; Hendee et al. 1990; Lime and Lewis 1997; Lundgren 1996; Manning et al. 1984; McLean and Johnson 1997; Morton 1997; Peterson 1983, 1992; Peterson and Lime 1979; Rosenthal et al. 1984; Schultz et al. 1988; Shelby et al. 1982; Walsh et al. 1989; White 1993; White et al. 1995.

Regulation

restrict access to specific locations (zoning)

restrict use/behavior at facilities

restrict/ prohibit activities

restrict/prohibit equipment

restrict/prohibit modes of travel

limit length of stay

limit group size/ stock/ pets

restrict/ prohibit use to protect environmental conditions

Regulations

The purpose of regulations is to control the nature of visitor use in an area. Regulations tend to be very specific in terms of what is and what is not allowed.

Regulations frequently attack the cause of visitor use problems directly. If off-trail travel is extending resource damage beyond the designated impact zone, prohibiting off-trail travel directly addresses the cause of such impacts. However, regulations sometimes address the cause of the problem indirectly. For example, if visitor crowding is a problem throughout an area, imposing a length of stay limit will not alleviate crowding if the action only leads to faster turnover of use with no overall reduction in the number of visitors.

Regulations generally are both direct and obtrusive. Regulations are intended to control visitor behavior directly, and, as such, they significantly limit visitor freedom of choice. Further, to the extent that regulations are communicated via signs, literature distributed to visitors, and personnel, they also tend to be obtrusive. Regulations may have a subtle, negligible, or even a positive effect upon visitor experience when the visitor personally believes the regulation is appropriate and necessary. For example, results from the USDA Forest Service's survey of river recreationists (1978-80), as reported by Schomaker and Knopf (1985), indicate that the number one management action supported by river users was requiring visitors to carry out their own trash. If managers were to implement such a regulation, positive effects on visitor experiences would likely result, particularly to the extent that the regulation was effective in reducing litter. Schomaker and Knopf (1985) conclude that visitors support a regulation when it does not limit their choices before engaging in recreation, but affects their satisfaction after the choices to participate have been made.

Another important source of visitor support for regulations is who is the perceived target of the regulation. If visitors believe regulations control the behavior of other recreationists whose behavior does not match the visitors own preferences or standards, support for the regulation is likely to increase.

To decide whether to implement visitor use regulations is to weigh the costs and benefits to both visitors and management against the expected effectiveness of eliminating an unacceptable impact (table 5). Expected results should then be compared with outcomes that might be obtained from various nonregulatory management tactics (Lucas 1983). In addition, implementation of regulations must be consistent with the overall management objectives for an area, particularly as they relate to the type of recreation opportunities for which an area is managed. For example, when

Table 5. Guidelines for the use of regulations to address unacceptable impacts.

• **Do not regulate if effective nonregulatory alternatives exist.** Establishing a regulation, by itself, achieves nothing out in the real world, although it may provide a sense of satisfaction that *something* is being done. - Is it possible to inform visitors of each regulation? - If visitors are informed about a regulation and understand it, will their behavior change enough to solve the problem? - If the regulation changes visitor behavior as intended, will this really help achieve management objectives?
• **Try to develop effective nonregulatory visitor management.** There are two main types of indirect, nonregulatory actions that managers can employ—design and education.
• **Explain regulations.** An explanation of necessary regulations should improve compliance . . . [and] reduce the costs to visitors by reducing perceptions of regulations as arbitrary hassles. . . . Trying to develop an explanation of a regulation may also identify weaknesses in the rationale linking the regulation to a management problem.
• **Regulate at the minimal level needed to solve the problem.** Regulations span a continuum from severe to relatively mild. Avoid regulations that are stricter or more sweeping than needed or that restrict visitor behavior that is not part of the problem.
• **Regulate at the entry level rather than at the activity level within an area.** . . . Freedom and spontaneity can be preserved if most regulations are applied outside the area at the time of entry; those admitted to an area would be substantially free to travel and camp . . . with little regulation. Limits on number of visitors admitted, party size, and method of travel are examples of 'outside' regulations; assigned campsites or prescheduled travel itineraries are examples of 'inside' regulations.
• **Monitor the problem and the effects of the management action.** Monitoring of some sort is essential because most management actions are taken with only a limited understanding of their likely consequences; monitoring is the only way to determine what the actions really accomplish.
• **Finally, when considering recreation regulations, managers need to remember that visitors are one reason [parks] exist.**

Source: Hendee, Stankey, and Lucas (1990).

managing for unconstrained recreation opportunities, such as those found in designated wilderness or backcountry areas, an overreliance upon regulatory management tactics would be inappropriate. As Hendee et al. (1990) note: "Apply only the minimum regulations or tools necessary to achieve wilderness area objectives" (p. 418).

Numerous benefits, such as increased visitor safety, eliminating behavior that interferes with the freedom and enjoyment of others, and separating conflicting types of uses, may be attained by implementing regulations (Lucas 1983). Regulations can compensate for the "unfairness" of indirect approaches that often result in "preaching to the choir" (McAvoy and Dustin 1983).

When demand increases beyond specified carrying capacities, regulation can complement rationing efforts. For example, making a limited number of permits available to visitors ensures that the overall number of visitors entering an area is kept within limits but does not directly control distribution of use throughout the area. Regulations regarding entry date, place, and time might be appropriate ways to influence this aspect of the character of visitor use.

A final benefit of regulatory tactics is that they preserve freedoms that many would not otherwise enjoy (Dustin and McAvoy 1984). For example, by requiring wilderness visitors to camp at designated campsites, impacts to resources are concentrated in designated impact areas, allowing visitors to enjoy the area while still preserving the primitive character of the resource. Without such regulations, carrying capacities probably would have to be set at a much lower level to provide for adequate resource protection.

A number of costs are associated with regulations. These include administrative and enforcement costs, limits to visitor freedom and other undesired impacts to visitor experiences, and communication-related costs (e.g., publications, mailings, signs, personnel time). In general, visitors bear most of the burden of regulatory tactics, although management costs in terms of enforcement may be high (McCool and Christensen 1996). Managers also have observed that establishing "rules" does not prevent all unacceptable visitor behavior and may even incite such behavior among disgruntled visitors. Regulations are sometimes established without an awareness of possible intervening factors. Situations arise, particularly in backcountry areas, in which adherence to a regulation is difficult or impossible. McCool and Christensen (1996) report an incident in which, after a lengthy hike into a camping area near dusk, a group arrived to find that no suitable camping spaces were available at the required distance from a nearby lakeshore. Several suitable sites were available, though within the prescribed minimum distance. Since it was almost dark and hiking back in the dark to the trialhead posed safety risks, the group decided to camp "illegally." In such cases, the regulation does not control behavior as intended, and visitor experiences may suffer because of feelings of guilt about disobeying rules. This example does not suggest the regulation involved is bad or unnecessary, it shows that imposing regulations can lead

to unanticipated effects. Thus, when regulations are used to prohibit specific behaviors, managers should make sure suitable alternatives exist to the unacceptable behavior. Such precautions are likely to ensure visitor compliance.

Research has shown that managers often believe regulation is more effective than indirect management tactics to reduce visitor use problems (e.g., Bury and Fish 1980). However, managers also realize that regulations are effective only if visitors know about the regulation and are motivated to comply. Even so, regulations are routinely violated by a sizable number of visitors. The reasons for such violations are varied (Gramann and Vander Stoep 1987). Thus, just as regulations that control character of use are often linked with rationing tactics that control the intensity of use, specific regulations may be effective when linked with tactics associated with deterrence and enforcement and visitor education.

In this handbook, regulator tactics are identified according to general categories within which regulations can be grouped. The regulatory tactics discussed in this section are:

- restrict access to specific locations (zoning)
- restrict use/behavior at facilities
- restrict/prohibit activities
- restrict/prohibit equipment
- restrict/prohibit modes of travel
- limit length of stay
- limit group size/stock/pets
- restrict/prohibit use to protect environmental conditions

Restrict access to specific locations (zoning)

Purpose

Location-based regulations modify the character of visitor use by controlling visitor access to certain areas and activities in those areas. Management objectives that may be served by location-based regulations include distributing visitor use and preventing incompatible types of uses from occurring in the same area.

Description

Location-based regulations include regulations based on zoning, access points, and route restrictions. Establishing management zones is often a prerequisite for implementing location-based regulations. Regulations based on identified management zones allow managers to segregate different types of visitors, maintain diverse and high quality recreation opportunities, and protect desired resource conditions. Regulations based on access points allow managers to influence traffic flow patterns—a main factor leading to crowding and congestion. Finally, route restriction regulations may be implemented to restrict visitors to particular locations within the park, to keep them out of problem or sensitive resource areas, or to control traffic flow patterns directly.

Location-based regulations directly address the causes of unacceptable impacts to resources and visitor experiences. For instance, the recreation literature provides many examples of visitor conflicts arising from the presence of incompatible uses. The most frequently cited incompatible uses are motorized and nonmotorized recreational activities. It does not matter if it is motorboaters and canoers, snowmobilers and cross-country skiers, or ORV users and backpackers. Frequent encounters between motorized and nonmotorized users leads to visitor conflicts and/or a diminished quality of experience for the nonmotorized recreationists. To alleviate conflicts of this sort, managers can create motorized and nonmotorized use zones and establish regulations to ensure use will conform to the zoning designations.

Location-based regulations are direct management tactics. However, the level at which they control visitor behavior varies. As part of zoning, managers designate specific activities permitted within a specific area. Once visitors are within the specified area, visitors are often free to pursue their chosen recreational activity without further restrictions. Regulations that direct visitors to specific access points within an area tend to exert a great amount of control on visitor behavior. The travel area to which these visitors are restricted is limited to portions of the park that can be accessed from their point of origin given the time constraints they have. The most restrictive application of location-based regulations occurs whenever visitor travel routes are prescribed for them, often with designated campsites

determined in advance. In the latter case, visitor behavior is controlled over the entire course of the visitor's time onsite as opposed to before the visitor's arrival or at the point of their arrival.

Location-based regulations vary in terms of how subtle or obtrusive they are. Less restrictive location-based regulations, such as those based on management zones that direct visitors to specific areas of the park for specific types of visitor experiences and activities, are more subtle. Regulations controlling where visitors can access the park or a specific area within the park, or dictating where a visitor must be on a day-by-day basis, are generally perceived as obtrusive.

Costs to visitors

Low to High. Costs to visitors include reduction in freedom of choice and movement. Depending on the regulations in place, visitors may not be able to visit their preferred destinations, engage in the desired activities, or attain the experiences for which they undertook the trip. Since location-based regulations are frequently used in backcountry areas, their effect on visitor experiences may be greater than if they were used in frontcountry areas. The costs may be outweighed by the benefits, though. The latter is especially true if the location-based regulations work to preserve the unique conditions for which an area is being managed while minimizing visitor conflicts.

Costs to management

Moderate. Once zones have been delineated through an established park planning process, location-based regulations are one of the most common ways of ensuring that the recreation opportunities for which an area is being managed are maintained. However, management must spend a great deal of time and effort during the course of the planning process to ensure that only regulations necessary to realize management goals are implemented. Consideration of how the other management tactics of site management, rationing and visitor education can be used to augment or replace regulations is crucial.

When more restrictive location-based regulations are implemented, management costs increase. The time and effort it takes for managers to designate access points, or entire travel routes that visitors must follow, adds to management costs. But, depending on the resource (for example, travel routes on rivers), and the level of familiarity with preferred visitor access points, and traffic flow patterns, fairly fine-tuned location-based regulations can be established. In general, increased restrictions on visitor behavior lead to increased time and effort management must devote to enforcement.

Effectiveness

Even though many visitors comply with zoning regulations, problems can occur in transition areas where, for example, motorized use can spill over into nonmotorized use zones. Effectiveness also is reduced when location-based regulations conflict with the experience opportunities visitors seek. For example, in the Eagle Cap Wilderness in Oregon, a 200-foot no-camping zone was established around lakes to facilitate visitor solitude and reduce unacceptable lakeshore impacts. Rangers estimated that about half of all parties did not comply with this regulation. Visitors may not have complied because the experience of camping near water was highly valued by visitors or maybe because more suitable sites were within the 200-foot zone (Lucas 1982). In any case, an estimated 50 percent noncompliance rate suggests that regulations can be ineffective when managers know little about visitor motives.

The Boundary Waters Canoe Area Wilderness in Minnesota combines rationing and regulatory approaches to control the intensity and character of visitor use. Permits are issued on the basis of advance reservations, and a specific access point is designated. Zoning is used to specify motorized and nonmotorized zones, allowing visitors to plan their trip accordingly and to reduce visitor conflicts. Significantly, once the visitor has entered the wilderness via the designated access site, no further travel restrictions exist. Rather than implementing regulations that delimit visitor freedom, managers have worked with researchers to develop traffic flow models so that travel patterns can be predicted with a high degree of accuracy (Peterson et al. 1977). Thus, the number of permits and visitor access points can be assigned in ways that contribute to management objectives for the area.

Marion et al.'s (1993) survey of backcountry managers showed that 25 percent of parks prohibited camping within specific designated backcountry areas and 15 percent of the parks required camping within specific designated backcountry areas. Location-based fire regulations were also fairly common. Forty-seven percent of parks prohibited ground fires in specific backcountry areas compared with 43 percent where ground fires were prohibited throughout the backcountry.

Selected references

Anderson and Manfredo 1986; Cole 1994; Cole 1997; Cole et al. 1987; Cruz and Jiron 1994; Lucas 1982, 1983; Manning et al. 1996; Marion et al. 1993; Peterson et al. 1977.

Restrict use/behavior at facilities

Purpose

Facility-based regulations modify the character of visitor use by controlling visitor behavior related to various facilities within an area. Facility-based regulations are one approach to controlling undesired impacts that relate to roads, trails, campsites, restrooms, parking lots, visitor centers, and any other facility constructed on park property.

Description

Facility-based regulations control visitor behavior at various park facilities. For example, facility regulations may govern the use of fire at campsites, require camping at designated sites, or result in a campsite assignment program. Facility-based regulations related to trails might include requiring pets to be on a leash, restricting bicyclists to bicycling trails only, prohibiting shortcutting on switchbacks, or prohibiting off-trail travel all together.

Facility-based regulations overlap with other regulatory management tactics. For example, a campsite length of stay limit could be considered a facility-based or a time-based regulation. Prohibiting the use of trails in the spring, when moist trail conditions lead to increased impacts to soil and vegetation and to trail widening, could be considered a facility-based regulation or a resource condition-based regulation. This overlap can assist managers in thinking through their options to resolve unacceptable impacts. Managers are more likely to consider a range of options when they approach an impact from a variety of perspectives.

Facility-based regulations, by focusing on a specific place where problems occur, directly address the causes of many impacts. For example, if managers observe vehicles parked alongside park roads, a regulation prohibiting stopping along park roads (except at designated pull-offs) could bring this problem under control and reduce impacts related to wildlife interference and traffic safety. Facility-based regulations also work with other management tactics that directly address the cause of a problem. If visitors are making or using existing fire rings inappropriately at campsites, banning all use of fires at campsites does not address the underlying cause of the impact. Incorrect use of fire rings by visitors. In this case, it is incorrect use, not use in general, that causes the unacceptable impact. The most effective regulations target the specific practices contributing to unacceptable impacts.

Facility-based regulations are a direct management tactic. For almost every regulation that prohibits some visitor behavior, there is a corresponding visitor education tactic that would discourage such behavior (or encourage

alternative behaviors). Whether regulatory or education tactics are used, the reason why the unacceptable behavior leads to undesired impacts to resources or visitor experiences should be explained to the visitor.

Facility-based regulations are generally obtrusive. Regulations convey specific “do this” or “don't do this” messages to visitors. Campsite assignment is one of the most obtrusive forms regulations can take in backcountry areas because it places significant constraints on visitor freedom. Some facility-based regulations may be intuitive—to put out all fires completely before leaving a campsite. Intuitive regulations may be more subtle than less intuitive regulations in terms of how they affect visitor experience. It may not be the regulation per se, but rather how managers choose to communicate a regulation to the public that determines how subtle or obtrusive visitors will perceive it to be.

Costs to visitors

Low to High. Costs to visitors vary with the nature of the regulation, how restrictive it is, and how managers communicate the regulation to the visiting public. To the extent that these regulations protect resources, prevent the deterioration of trails, campsites and other susceptible facilities, ensure visitor safety, distribute visitor use, and enhance visitor experiences, costs associated with their regulatory nature may be more than compensated.

Costs to management

Moderate. In general, visitors bear the cost of regulations. Costs to management increase, however, proportionally to how restrictive a regulation is. More restrictive regulations tend to require more staff time and effort to implement and enforce. If managers implement a campsite assignment regulation, a system for assigning campsites must be devised and care must be taken to ensure that double-bookings and/or noncompliance do not occur. When these things occur, they threaten the functioning of the system. Other costs that accrue to management relate to communicating regulations to the public, explaining why regulations are necessary, and enforcing regulations.

Effectiveness

Moderate. Regulations are most effective when they are based on a thorough area-by-area analysis. Many visitors understand and agree with the reasons for a specific regulation. Thus, compliance is often high. Unforeseen circumstances can intervene and result in visitor violations of a regulation. For example, although a visitor may have planned to follow a “camp at designated sites only” rule, a minor injury or harsh weather conditions can intervene to prevent compliance.

Since facilities like trails tend to support large numbers of visitors, facility-based regulations can be less effective by one or two cases of noncompliance. For example, in a study conducted in Mt. Rainier National Park, researchers observed that although signs were clearly posted indicating that off-trail travel was prohibited, when one or two visitors ventured off-trail in plain view of others, a larger percentage of visitors than normal walked off-trail (Swearingen and Johnson 1994). Canon et al. (1979) reported that in a New Hampshire wilderness, no campers complied with a regulation prohibiting camping within 200-feet of trails.

McCool and Christensen (1996) indicate that campsite assignment is fairly common in western whitewater rivers, including the Green and Yampa rivers at Dinosaur National Monument and in some national park backcountry areas, such as Big Bend, Glacier, and Yellowstone national parks. The benefits associated with this regulatory system include optimal use of facilities, and a reduction in interparty competition. The costs attributed to a campsite assignment system include decreased visitor freedom and high administrative costs.

The Boundary Waters Canoe Area Wilderness has implemented a series of facility-based regulations (Andersen and Lime 1984; Soderberg 1987). Visitors are required to camp at designated campsites, build fires only in fire grates, and limit party size to nine people (three watercraft). These regulations have been effective at concentrating visitor use, thus protecting nondesignated campsite areas from human disturbance.

Marion et al. (1993) surveyed NPS backcountry managers and found that 64 percent of parks surveyed have backcountry campsite length of stay limits. The objective of this regulation is to ensure adequate turnover of campsites and to reduce campsite impacts. However, this facility- and time-based tactic is probably not very effective since only 1 to 2 percent of backcountry visitors stay in the backcountry as long as their mean length of stay limit (i.e., nine nights). The latter situation highlights what Lucas (1982) emphasized in his article on recreation regulation—adoption is sometimes largely intuitive and effectiveness often is assumed.

In the same survey, Marion et al. (1993) found that parks frequently implement backcountry camping regulations. For common regulations, 46, 44, and 20 percent of parks prohibit camping within a specific distance or sight of roads and other facilities, water, or trails, respectively. Regulations requiring visitors to camp at designated campsites in the backcountry, or only in specific areas, were implemented in 25 and 31 percent of the park backcountry areas.

Selected references

Andersen and Lime 1984; Cole et al. 1987; Lucas 1982; Manning et al. 1996; Marion et al. 1993; McCool and Christensen 1996; Soderberg 1987; Swearingen and Johnson 1994.

Restrict/prohibit activities

Purpose

Activity-based regulations modify the character of visitor use by controlling activities in which visitors may engage. In conjunction with location, facilities, and time-based regulations, they delineate the basics regarding the where, when, and what of visitor behavior. Activity-based regulations can be useful in preventing visitor conflicts due to incompatible uses.

Description

Activities that may be regulated include camping, hiking, canoeing, biking, the use of motorized recreational vehicles (snowmobiles, personal watercraft, swamp buggies), horseback riding, hunting, fishing, wildlife viewing, lighting fires, and packing out trash. Activities can be either prohibited or required and regulations can pertain to private as well as commercial operations.

Licensing is a common form of activity-based regulation. Both private individuals and commercial outfitters or guides can be required to obtain a license to engage in a specific activity. Licensing can be used to impose merit or eligibility requirements, to restrict the rate or place of entry into a recreation area, to limit the kinds of activities permitted, and to specify when and where activities will take place (Stankey and Baden 1977). If licensing is used as a means to limit use, it should not be considered an activity-based regulation but rather a rationing and allocation tactic.

Activity-based regulation can address the underlying cause of the unacceptable impact to resources or visitor experiences. Activity-based regulations also may be used with other management tactics to address the causes of unacceptable impacts. For example, if encounters with packstock groups on trails diminishes the experience of hikers, an activity-based regulation prohibiting the use of packstock on some or all trails would address the problem of packstock group conflicts with hikers. If the problem is soil compaction and root damage resulting from groups hitching their packstock to trees at campsites, then prohibiting the use of packstock would not address the cause of the problem—packstock being hitched at sites susceptible to impact. Rather than prohibit the use of packstock, a tactic to prevent soil compaction and root damage would be to install hitching posts in more durable areas. In this case, only if the construction of hitching posts is incompatible with management objectives for an area, and other tactics are likewise ruled out, should managers consider implementing an activity-based regulation in this case.

Activity-based regulations are a direct management tactic. Like all regulations, activity-based regulations attempt to control visitor behavior by restricting activities in which visitors can engage. As such, activity-based regulations tend to be highly obtrusive. One key component of any recreational experience is the activity in which the visitor engages. Preferences for specific activities are strong. Frequently, activities take on a social nature, which allows individuals to meet a variety of psychological needs. Management actions that prevent individuals from engaging in desired activities either alone or in the companionship of others are likely to lead to a strong sense of "being managed" on the part of the visitor.

Costs to visitors

Low to High. If visitors understand the reason behind the activity-based regulation, costs may decrease. In addition, if the restricted activity is not very important to visitors, costs may be minimal. Very often, however, costs to visitors are high for activity-based regulations. Costs tend to increase when the regulated activity is important to visitors, the desired activity is not permitted at all, and the area in which the activity is permitted is strictly delimited.

When a previously allowed activity is restricted, visitors who used to engage in that activity experience high costs and often fight to maintain the status quo. Visitors often support activity-based regulations which affect others but not themselves. Thus, conflicts between competing uses can escalate quickly and can be difficult to diffuse. This climate of conflict also represents a significant cost to visitors.

Costs to management

Low to High. In addition to communication and enforcement-related costs, management must also resolve conflict situations that arise when activities are restricted. Depending on site-specific factors, enforcement can be difficult and, therefore, costs can be high for staff time.

Effectiveness

Restricting specific types of activities can lead to significant reductions in unacceptable biophysical impacts and visitor conflicts, as well as increased visitor safety and satisfaction. For example, regulations restricting the use of campfires are associated with a significant reduction in campfire-related impacts. Similarly, regulating the use of campfire-related activities, such as the collecting of green material, can also be effective in reducing unacceptable impacts. Activity-based regulations can also eliminate visitor conflicts related to incompatible visitor activities. The latter is especially true with activity-based regulations related to separating motorized and nonmotorized uses.

McCool et al. (1990) surveyed visitors who engaged in three types of activities in a Montana wilderness. The authors found that each group viewed restricting the activity engaged in by the other two groups as acceptable, but were unwilling to have the activity in which they engaged regulated.

In their survey of NPS backcountry managers, Marion et al. (1993) found that 43 percent of the parks surveyed prohibited starting ground fires in all backcountry areas; 47 percent prohibited starting ground fires in specific recreation areas.

Selected references

Anderson and Manfredo 1986; Cole et al. 1987; Cole and Dalle-Molle 1982; Frost and McCool 1988; Manning et al. 1996; Marion et al. 1993; McCool and Christensen 1993; Peterson and Lime 1979.

Restrict/prohibit equipment

Purpose

Equipment-based regulations control the character of use by regulating the use of specific technologies and materials that can cause unacceptable impacts to resources and visitor experiences.

Description

A variety of technologies exist that can be used in parks to address unacceptable impacts to resources and visitor experiences. Examples of such technologies include cook stoves, lanterns, fire-pans, portable toilets, portage wheels, saws and hatchets, some kinds of climbing equipment, weapons, electronic devices, and materials such as plastic, glass, and metal. Restricting the type of equipment allowed in park areas is comparable, in some instances, to requiring specific skills and training to meet entrance requirements. Thus, there is a close link between eligibility requirements and equipment requirements.

Equipment-based regulations may address the cause of the problem or be used with other tactics that address the underlying cause of unwanted impacts. For example, requiring the use of fire-pans, cookstoves, or designated fire grates/fire rings, while simultaneously prohibiting unacceptable use of fire, are tactics that directly prevent campfire impacts in parks. A common problem in developed and backcountry campgrounds is scars on tree bark caused by visitors hanging gas lanterns on trees. Banning the use of gas lanterns seems to directly address the cause of the problem. However, the cause of the problem is not the use of gas lanterns, rather, it is the behavior of the visitor (i.e., hanging the lantern on the tree) that causes the burn. In this situation, a regulation prohibiting hanging lanterns on trees or a visitor education effort attempting to persuade visitors not to hang lanterns on trees would directly address the cause of the problem.

Equipment-based regulation is a direct management tactic. Once the use of specific equipment, technologies or materials is required or prohibited, visitor behavior is directly impacted. In addition, these regulations are fairly obtrusive in that the character of the visitor's experience can be greatly altered by prohibitions on specific uses. In some cases, however, such as when safety equipment is required for rock-climbing, management regulations may simply be in keeping with standard procedures most visitors already follow. Such regulations are likely to be perceived as subtle, and may not be necessary.

Costs to visitors

Low to High. Costs depend upon the extent to which visitors are obliged to alter their behavior or equipment use from preferred patterns. Costs to visitors can be minimized if visitors understand the purpose behind the equipment-based regulations. Costs are highest when visitors are asked to forego highly valued experiences or experiences inextricably linked to a particular setting. An example is the use of campfires in backcountry camping areas. Some individuals may find the prohibition of technologies, which are relied upon for safety or convenience, lacking justification, thus generating frustration at having to "do without."

Costs to management

Moderate. Costs to management include the time, effort, and funds needed to communicate and enforce regulations. Special attention must be paid to explaining to visitors why particular equipment requirements or prohibitions are necessary.

Effectiveness

Equipment-based regulations are particularly effective at eliminating unacceptable biophysical impacts, such as fire scars, improper human body waste disposal, multiple fire-rings or cooking areas, and broken glass. Their effectiveness in controlling visitor use levels is relatively untested, although prohibiting the use of specific technologies might lead to a substantial reduction in visitor use in some areas (Wuerthner 1985).

In their survey of NPS backcountry managers, Marion et al. (1993) discovered that 22 percent of parks required specific skills or equipment for some backcountry uses. A commonly required piece of equipment was a cook stove, with 37 percent of the parks requiring their use in backcountry areas.

Selected references

Cole et al. 1987; Manning et al. 1996; Marion et al. 1993; McCool and Christensen 1996; Wuerthner 1985.

Restrict/prohibit modes of travel

Purpose

Mode of travel-based regulations control the character of visitor use by regulating how visitors access the park and how visitors move around within the park. Mode of travel-based regulations can help reduce traffic congestion, parking problems, conflicts resulting from incompatible visitor use, and other unacceptable resource impacts associated with transportation in the park.

Description

Mode of travel-based regulations can be as simple as designating where specific forms of transportation such as private vehicles, tour buses, park-operated shuttle buses, tramways, helicopters, trains, motorboats, personal watercraft, motorcycles, ORVs (including 4-wheel drives, snowmobiles, swamp buggies, etc.), pack stock, bicycles, skateboards, canoe, kayak, and/or pedestrian traffic are allowed within a park, or as complex as mandatory use of visitor transportation systems (VTS) where arrangements must be made for shuttling visitors from staging areas to various attraction sites within the park. VTSs are designed to accommodate large numbers of park visitors without the unacceptable congestion and resource impacts associated with private vehicle use. As with location-based regulations, mode of travel-based regulations are zone dependent. Managers specify the types of motorized and nonmotorized transportation permitted in an area.

Mode of travel-based regulations may directly address the cause of a problem or may be used along with other tactics to address the causes of unacceptable impacts. For example, if conflicts between motorized and nonmotorized users contributes to decreased satisfaction among some visitors, managers may prohibit specific modes of transportation to alleviate these conflicts.

Mode of travel-based regulations are direct management tactics. They may be either subtle or obtrusive. Because these regulations influence visitor behavior directly, tend to be obtrustive. However, not all mode of travel-based regulations are obtrusive. To the extent that prohibitions conform to landscape constraints, the regulations may be perceived by visitors as subtle and reflecting good sense.

Costs to visitors

Low to High. The primary cost to visitors is the loss of freedom associated with transportation restrictions. If visitors prefer to travel by motorboat, canoe, bicycle, off-road vehicle (ORV), private vehicle, tour bus, on horseback, or on foot, regulations preventing these modes of travel within

an area can lead to significant visitor costs. In addition, VTSs, which require visitors to travel in shuttle buses, often at full capacity and with limited autonomy, impact visitor experiences. Some visitors oppose the close quarters and the lack of freedom, while others enjoy the socializing and the additional interpretive services frequently provided on shuttles.

Costs to management

Moderate to High. Increased visitation typically increases management's costs to operate a transportation system that provides the recreation opportunities and flexibility visitors desire, while protecting park resources. Protecting park resources often is accomplished by sacrificing resources in less widely used areas of the park. "Sacrifice" areas often are related to the parking requirements associated with operating the staging area where visitors park their cars and load and unload from a VTS. Costs increase as distance from the staging area to park destination points increases. This level of intense development represents a management cost in terms of management's ability to maintain acceptable social and biophysical settings, particularly where maintaining natural appearing landscapes is a park management objective.

Effectiveness

The effectiveness of travel-based regulations varies. Travel-based regulations are often most effective when associated facilities are modified. For example, barriers may be installed to prevent vehicular access but to allow pedestrians access. In terms of effectiveness at protecting park resources, travel-based regulations can effectively concentrate use to designated impact zones. But, areas served by VTSs have to absorb concentrated visitor use, potentially leading to unacceptable resource impacts. VTSs are more likely to be effective at reducing traffic congestion than at alleviating visitor crowding. A properly designed VTS should ensure that the acceptable number of visitors can be shuttled to the park and within the park without unacceptable levels of traffic congestion. when visitor crowding is the problem, though, implementing a VTS will not alleviate it. VTSs transport and drop off visitors *en masse,* which may lead to increased crowding, at least until visitors are able to disperse. However, since most visitors flock to specific attraction sites, dispersion may not occur, thus further contributing to crowded conditions in popular areas. The exaggerated "pulse" of visitors resulting from mandatory VTSs may be acceptable, though, because unless severe use limits are put in place, attraction sites are likely to remain the most crowded spots in a park.

In the NPS in 1995, 12 parks ran NPS-operated VTS and another 23 parks provided concessioner-operated VTS (Byrne and Schumm 1995). It is not clear how many of these parks require visitors to use VTSs in lieu of private

vehicles, although Denali National Park is an example of a park operating a mandatory VTS. Results of VTS case studies conducted at Denali, Yellowstone, and Yosemite, showed that the key considerations for VTSs were: (1) visitation levels, (2) use patterns, (3) infrastructure development and needs, and (4) visitor experience.

In the Grand Canyon National Park portion of the Colorado River, motorized river use is allowed during the peak season summer months but not during autumn. This regulation combines mode of travel-based and time-based elements to minimize visitor use conflicts.

In discussing motorized use on wild and scenic portions of the Snake River in Hells Canyon, Michael Cole (1989) relates that as a result of legislative battles to preserve motorized access to the Snake River, coupled with aggressive marketing by tour operators, approximately 66 to 90 percent of the annual use is motorized. His study findings illustrate that increasing conflict between float groups and motorized river users cannot be resolved by mode of travel-based regulations as long as the existing legislation stands. In this case, managers must consider whether any combination of mode of travel-based regulations with equipment-based, time-based, environmental conditions-based, or behavioral-based regulations is possible; or, whether other regulations could alleviate visitor conflicts.

In addition to legislative constraints, McCool (1977) indicates that the very complexity of travel-based problems works against easily won solutions. A series of focus groups on management issues surrounding ORV use suggests that it is not just a matter of solving the ORV problem, but that an overwhelming part of the task is defining exactly what the ORV problem is. Focus group participants, including representatives from all relevant stakeholder groups, identified almost 450 separate issues related to managing ORV use. Although this number of separate but related issues seems unmanageable, it is indicative of the extent to which some modes of travel lead to extensive resource and visitor experience impacts. It also reflects the strong conviction among some stakeholders that appropriate uses of ORVs and other motorized forms of transportation are appropriate uses on public lands and opportunities should be provided for them.

Selected references

Byrne and Schumm 1995; Cole, D. N. 1989a; Cole, M. L. 1989; Cole et al. 1987; Hammit and Cole 1998; McCool 1977.

Limit length of stay

Purpose

The purpose of time-based regulations is to control the character of visitor use in such a way as to reduce unacceptable impacts to resources and visitor experiences.

Description

Time-based regulations or length of stay limits, include day-use only restrictions, entry date and time assignments, peak season or shoulder season-based regulations, and tour scheduling or trip scheduling. Length of stay limits are frequently used for campsites to ensure an adequate turnover rate so that facilities or scenic attractions may be enjoyed by a large number of visitors. Day-use only restrictions may serve to eliminate some unacceptable or noncompliant visitor behavior. With tour scheduling, for example, visitors choose from among several designated times when guided tours are offered of natural phenomena, historic sites, or interpretive films. With trip scheduling, visitors are assigned both a route and an appointed date for each place on the itinerary. Trip scheduling may be zone-specific—visitors must be within a specific zone on a specific day. Or, trip scheduling may be campsite specific—visitors are assigned a specific campsite for each day of their trip.

Time-based regulations generally do not address the cause of an unacceptable impact. They are best used with other tactics that directly address the causes of unacceptable impacts. The amount of time a visitor stays in an area is usually not a direct cause of unacceptable impacts to resources or visitor experiences. Implementing time-based regulations, however, may be more effective at resolving some impacts than implementing regulations to directly address specific behaviors of concern. For example, late night partying and consumption of alcoholic beverages occurs in many overnight camping spots. A large number of municipal parks discourage such behavior by not allowing overnight use. This regulation simplifies enforcement efforts since enforcement personnel can move through an area looking for anyone present after a certain hour in the evening. Tour and trip scheduling reflect a primary use of this management tactic because they can lead to a direct reduction in crowding.

Time-based regulation is a direct management tactic. Once regulations are in place that require visitors to engage in recreational activities at a specified time or date, visitors are left with little room for personal decision making.

Time-based regulations may be either subtle or obtrusive. Visitors who reserve a campsite, a spot in a guided tour, or a wilderness permit expect to

reserve them for a specific date and possibly a specific time. In these cases, the effect of the time-based regulation is subtle, unless the desired time slot is unavailable. On the other hand, time-based regulations are obtrusive when they encompass trip scheduling that severely limits visitor freedom.

Costs to visitors

Low to High. Costs vary depending on the time-based regulation in place. Entry date, time, and length of stay regulations tend to impart lower costs to visitors. The low cost to visitors associated with length of stay limits is because average length of stays for recreational settings tend to be below the stipulated maximum length of stay. Even so, for some, the lack of an opportunity to enjoy an extended stay in an area represents a potential loss—a loss whose impact is probably inversely proportional to the small numbers likely to be affected.

Costs to management

Moderate to High. For time-based regulations to be effective, they must be adequately enforced. Enforcement is a time-consuming management effort. In addition, if entry date and time or trip scheduling regulations are implemented, such regulations piggy-back off a well-functioning reservation system or another type of rationing system. The administrative costs for assigning an entry date (and time of day, in some cases) adds to the overall cost of a permit system since most permits are date-specific. However, many permits that specify an entry date also specify an entry location. Specifying both a date and location ensures that visitor use is adequately dispersed. It also complicates the permitting process. the most complex systems are those that assign entry date and place as well as assign each group a day-by-day route or itinerary, which may be zone specific or campsite to campsite specific. Administrative costs for such a system are high. In addition, personnel costs for the interpretive services offered as part of scheduled group tours are moderately high; and, the strain associated with the peak season usually requires hiring seasonal help.

Effectiveness

Time-based regulations vary in their effectiveness at addressing unacceptable impacts to resources and visitor experiences. Although length of stay limits may function to increase the turnover rate of campsites, they are unlikely to affect the temporal and spatial distribution patterns contributing to many unacceptable impacts. Day-use only restrictions are fairly effective at eliminating excessive consumption of alcoholic beverages and other inappropriate behavior by groups camping overnight within parks. Such restrictions make enforcement efforts easier. Tour scheduling is a highly effective means of alleviating crowding and unmanageable group size for interpreted tours. Trip scheduling is probably one of the most effective

ways to eliminate crowding and control use distribution patterns. However, a high rate of noncompliance might be associated with unpopular and constraining regulations such as trip scheduling.

In their survey of backcountry managers in the NPS, Marion et al. (1993) found that 51 percent of the parks had implemented length of stay limits in backcountry areas. A sizable 64 percent of parks surveyed had campsite length of stay limits in place, with the mean limit being nine consecutive nights. However, as Marion et al. (1993) point out, only 1 to 2 percent of backcountry visitors stay this long in the entire backcountry. Therefore, such regulations are probably not effective in reducing campsite impacts or in increasing campsite turnover. Day-use only restrictions were found in only a small percentage of national park backcountry areas.

Selected references

Cole 1989a; Lime et al. 1995; Manning et al. 1996; Marion et al. 1993; McCool and Christensen 1996; McLean and Johnson 1997.

Limit group size/stock/pets

Purpose

The purpose of limiting group size/stock/pets-based regulations is to control the character of use by controlling group size. In the case where no pets are allowed, the character of use is modified by prohibiting animals, particularly dogs, from accompanying their owners.

Description

Limiting group size/stock/pets-based regulations include party size limits as well as limits on the number of people that may be at any place, at any given time. Regulations of this sort may preclude the use of stock or the presence of pets in specific areas. Restrictions against the use of pack stock also may be considered a mode of travel-based regulation. Party size restrictions are common in dispersed recreation areas. Prohibitions against pets, however, are common in frontcountry and backcountry settings, although pets are generally not prohibited outright.

To the extent that encounters with large groups negatively impact some visitors' experiences, implementing party size limits directly addresses the underlying cause of visitor dissatisfaction. However, if campsite degradation is the concern, implementing group size limits to counteract this problem does not address the underlying cause of the problem. Unless group size is the principle contributor to campsite impacts and unless group size limits are set low enough to compensate for these impacts, the regulation does little to affect specific group characteristics (e.g., size) that result in the unacceptable impacts.

Group size limits, and other number of people, pets, and stock regulations, are direct management tactics. Such regulations may be either subtle or obtrusive. Depending on the verbal and written communication managers give to visitors, visitors planning to visit in small groups without pets and pack stock, may not be aware that these restrictions are in place. In this case, limits would have little impact on these visitors' experiences, and would likely be perceived as subtle. However, visitors who are prevented from traveling in groups of some desired size, with pets, or with large numbers of pack stock, probably would find the tactic obtrusive.

Cole et al. (1987) make an important observation about the impact of party size limits: “Selecting a specific number for a party size limit requires judgment. No formula exists to calculate an ideal number. The situation is parallel to setting speed limits. In our opinion, however, party size limits larger than about 10 persons seem unlikely to have much positive benefit . . . provisions for allowing larger parties under special circumstances may be desirable” (p. 45).

Costs to visitors

Low to High. Limiting group size/stock/pets-based regulations are associated with a variety of costs to visitors. First, restricting party size can prevent larger groups who want to travel together from doing so. Similarly, if group size limits are extended so that no more than a prescribed number can be together at any time or place, visitor opportunities to gather with neighboring groups is restricted and a loss of desired social interaction opportunities may occur. However, since most groups have relatively few members, costs can be high for large groups, such as outfitted and organized groups. Informing visitors of such limits early during their trip planning is essential to keep visitor costs low.

Further, visitors who have previously experienced an area or an activity in a large group setting may find that a smaller group size lacks specific elements they look for in that recreation experience. Larger groups may be allowed in some areas to preserve this experience opportunity. In addition, any party size limits imposed by managers must not only ensure that acceptable social and biophysical conditions are maintained, but they also must be feasible to outfitters or tour group operators. McCool and Christensen (1996) found that limits on group size are generally accepted by visitors, particularly if all groups are limited to the same size.

Costs to management

Low to Moderate. The primary costs to management are communication and enforcement related. Visitors must be made aware of the specific regulations implemented as well as the conditions necessitating their use. Enforcement of party size limits is generally easier than enforcing rules prohibiting the gathering of more than a specific number of visitors at any time or any place. This tactic is not effective at attraction sites. Attraction sites are magnets. It is difficult to keep problems such as crowding under control at these sites through the use of this tactic.

Effectiveness

Because large groups tend to have a disproportionately greater impact on the biophysical and social environments than smaller groups, group size limits can be effective at reducing unacceptable resource and visitor experience impacts. If group size limits are low enough, they can be very effective at alleviating decreased visitor satisfaction related to encounters with large groups. However, group size limits may contribute little to reducing unacceptable impacts to resources unless limits are set relatively low. In addition, group size restrictions may be used on an area-by-area basis to resolve area-specific impacts.

Frequently, river and backcountry recreation areas have party size limits in place. More than 30 years ago, Lime et al. (1978) identified more than 30

rivers with party size limits throughout the United States. On most of those rivers, party size limits are still in place. Sometimes group size limits differ for commercial versus private groups. Such arrangements reflect differences in how managers allocate use between competing groups. In the mid-1970s, for example, Schreyer (1977) reported that on the Middle Fork of the Salmon River commercial groups had a party size limit of 26, whereas private groups were limited to 15.

Marion et al. (1993) in their survey of NPS backcountry managers found that group size limits are widely used in NPS-managed backcountry areas. Sixty-two percent of the study areas had group size limits.

Selected references

Cole et al. 1987; Cole, M. L. 1989a; Hammit and Cole 1998; Heywood 1985; Lime 1972; Lime et al. 1978; Manning et al. 1996; Marion et al. 1993; McCool and Christensen 1996; Roggenbuck and Schreyer 1977; Schreyer 1977; Stankey 1973, 1980a.

Restrict/prohibit use to protect environmental conditions

Purpose

The purpose of environmental conditions-based regulations is to modify the character of use to maintain appropriate resource and social conditions. Another way to characterize this type of regulation is “to prohibit use when impact potential is high” (Cole et al. 1987).

Description

Environmental conditions upon which regulations may be based include seasonal factors, weather-related conditions (e.g., wind, storm, fire, flooding, drought), geologic phenomena, the control of exotic species, and fragile ecosystems or vegetative types. Environmental conditions-based regulations parallel some mode of transportation-based, activity-based, and other restrictions that are used to protect wildlife species and fragile environments. For example, recent snowmobile restrictions in selected areas of Voyageurs National Park were implemented to maintain the environmental conditions conducive to the park's wolf population.

Seasonal factors include the wetness or dryness of soil and vegetation. Wetness heightens the impact of trampling and dryness heightens the danger of fire. For the most part, plants, fish, birds, and animals are most susceptible to adverse impacts during specific times of the year, therefore, regulations controlling the character and intensity of visitor use during these periods should assist in averting unacceptable resource impacts. A common form of environmental conditions-based regulations are the establishment of hunting and fishing seasons.

Environmental conditions-based regulations directly address the cause of the problem. For example, in the fragile environments associated with alpine vegetation or cryptobiotic soil, trampling by visitors is one cause of unacceptable impacts. Thus, prohibiting off-trail travel directly addresses the cause of the impact by concentrating trampling activity on existing well-worn treadways. Under extremely dry, summer weather conditions when fire danger is high requiring visitors to use a portable cook stove and banning the use of campfires is an environmental conditions-based regulation designed to prevent fires.

Environmental conditions-based regulations are also among the most subtle of the regulatory tactics identified. They tend to be viewed as common sense precautions as well as environmentally ethical regulations by visitors. “Leave no trace” visitor education programs reinforce the behavior that environmental conditions-based regulations require. Some aspects of environmental conditions-based regulations, however, may be obtrusive. For example, if managers stipulate that rock climbing is not allowed in

specific weather or visibility conditions and, if such conditions are based on the risks associated with beginning or intermediate climbers, then experienced climbers may find such constraints highly obtrusive and may resent not being permitted to assess for themselves whether risks exceed their skill level.

Costs to visitors

Low to High. Many visitors are more than willing to comply with regulations whose wildlife and resource protection function is evident. Costs to these visitors is minimal, and they will likely benefit from the knowledge that their recreational behavior does not jeopardize the integrity of the environment. However, if regulations threaten to eliminate preexisting types of use in an area, particularly motorized use, some visitors may believe that costs are high. If there are alternative areas in nonsensitive habitats for such types of use to occur, costs may be reduced. However, in some cases managers attempt to eliminate across the board recreational practices that nonparticipants believe are detrimental to natural environments. While eliminating such use may prevent the unacceptable impacts, the costs are extremely high to those who value recreation opportunity.

Costs to management

Low to High. Costs to management include funding for research and monitoring to document current environmental conditions and changes in conditions over time. They also include communication costs associated with informing visitors of the regulations in place and ongoing enforcement efforts. In instances of unacceptable environmental threats, such as the rapid spread of exotics, costs to management may be very high in terms of staff time and energy devoted to publicizing regulations and carrying out inspections and enforcement efforts.

Effectiveness

As long as compliance is high, environmental conditions-based regulations can be effective in eliminating unacceptable impacts to resources and visitor experiences. In addition, compliance is often enhanced because increased environmental awareness and newly emerging environmental ethics reinforce such behavior. If, however, such regulations interfere with previously existing recreational uses of an area, managers may find not only that compliance with regulations is low, but also that they are confronted with a heated public debate on whether the managing agency has the right to prohibit such use.

At three barrier beaches in Massachusetts, seasonal use restrictions were implemented successfully during the piping plover nesting season

(Deblinger et al. 1989). Study results showed that the piping plover nest sites were adequately protected and reproductive survival rates increased dramatically. In addition, the majority of visitors surveyed supported the seasonal closures for the purpose of protecting the plover nest sites and increasing reproductive success.

Marion et al. (1993) in their survey of NPS backcountry managers found that 35 percent prohibited camping in backcountry areas where sensitive ecosystems or vegetation types existed. In these cases managers required that visitors camp in impact-resistant ecosystems or vegetation types. One biophysical setting that was specifically mentioned as being off-limits to camping was sand dunes. In addition, a substantial number of parks discouraged camping in sensitive backcountry areas or encouraged camping in resistant backcountry areas.

Selected references

Cole et al. 1987; Deblinger et al. 1989; Manning et al. 1996; Marion et al. 1993.

Deterrence and Enforcement

provide signs

sanction visitors who engage in noncompliant behavior

provide personnel and law enforcement

Deterrence and Enforcement

Deterrence and enforcement is a category of management tactics to control and eliminate noncompliant visitor behavior by manipulating key elements of the managerial environment at recreation sites. This tactic category seeks to encourage visitors to act in responsible ways, while making explicit the prohibitions against and the consequences of undesired behavior.

Deterrence and enforcement are used in conjunction with other types of management tactics such as rationing, regulations, and visitor education. The procedures, rules, and standards for behavior established using these other management tactics can provide a yardstick to measure noncompliant behavior. Generally speaking, noncompliant behavior may be viewed as "any act that detracts from the social or physical environment" (Sharpe et al. 1994). More specifically, noncompliance may be defined as "minor rule-breaking behavior or failures to comply with minimum impact regulations (e.g., off-trail hiking, souvenir collecting, feeding wild animals, and littering)" (Johnson et al. 1994a,b).

In a survey of NPS managers (Johnson et al. 1994b), estimates of reparable damage caused by noncompliant behavior were millions of dollars per year. Managers indicated that historical sites suffer the most damage. They also reported the most common noncompliant behavior was littering. Overall, managers felt that tactics commonly used to deter noncompliance had limited effectiveness, such as visitor education, the presence of uniformed personnel, barriers, and sanctions. Nearly half the managers surveyed (43 percent) felt that such tactics were inappropriate because they adversely effect visitor enjoyment. However, 17 percent said that fines were the most effective way to reduce noncompliant behavior.

The causes of noncompliant behavior are not always what they appear to be. For example, at Mt. Rainier National Park, managers struggled with the problem of resource damage caused by visitor off-trail travel. A logical course of action might have been to implement a visitor education program that detailed the resource impacts associated with off-trail travel. Signs threatening stiff fines and uniformed personnel at key points where visitors ventured off-trail also might have been used. Although such tactics were not ruled out, planners and managers decided they needed more information about why off-trail travel was occurring. Observation of visitors showed that the bulk of off-trail travel occurred when visitors encountered a glacier or snow drift close to a path and stepped off to look at the glacier or drift. Thus, rather than using deterrence and enforcement tactics to control off-trail travel, the NPS undertook to redesign trails (Swearingen and Johnson 1988).

Despite using other types of tactics, significant numbers of visitors will continue to violate management rules and regulations intended to preserve acceptable resource and visitor experience conditions. These acts of noncompliance are motivated by a variety of needs and values (Gramann and Vander Stoep 1987). To combat noncompliant behavior, some authors (Vande Kampe et al. 1994a; Johnson and Vande Kamp 1996) have outlined specific guidelines NPS managers might consider (table 6). Even so, some researchers maintain that in spite of management's best efforts, there will always be those visitors who do not hear or accept messages about appropriate behavior (Swearingen and Johnson 1994). In such cases, individuals may only be persuaded through the use of signs, barriers, sanctions, and the presence of uniformed personnel. Others caution, however, that to be effective management actions must address the reason behind the behavior, and not just the symptom of the actual behavior itself (McCool and Braithwaite 1992; Vander Stoep and Roggenbuck 1996).

Three deterrence and enforcement tactics discussed in this section are:

- provide signs
- sanction visitors who engage in noncompliant behavior
- provide personnel and law enforcement

Table 6. Guidelines to address noncompliant behavior.

• In evaluating a deterrence technique . . . NPS managers must consider its deterrent effect, its impact on visitor experiences, and the level of noncompliance that is acceptable in their units.
• Multiple deterrence techniques should be used when attempting to deter noncompliance because no single technique is likely to deter all forms of noncompliance, or even to counteract the many motives for a single form of noncompliance.
• Decisions about deterrence techniques should not be based solely on the intuitive assessment of NPS managers using their own reactions to the intervention.
• NPS managers should consider stationing uniformed employees within sight of areas damaged by visitor noncompliance because the presence of such employees is one of the most promising means of deterring noncompliance.
• NPS managers should ask, "Why are visitors breaking this rule?" as a first step in controlling noncompliance. If an incentive can be readily removed, noncompliance may drop to acceptable levels.
• To maximize effectiveness, messages designed to limit noncompliance should be presented as close as possible to the place and time in which noncompliance is likely to occur.
• The current NPS focus on deterring noncompliance by instilling beliefs consistent with compliance should be altered to focus primarily on activating such beliefs in visitors who already have them rather than on converting the unconvinced.
• Showing visitors that noncompliant behavior damages NPS resources will only deter noncompliance for visitors who hold strong values inconsistent with such damage. Basic behavioral principles suggest that short-term rewards generally have more control over behavior than long-term negative consequences.
• Noncompliance can be reduced by removing evidence of prior noncompliance, and by providing evidence that most visitors follow the rules.
• When noncompliance is deterred by threats of punishment, the threats should be accompanied by messages emphasizing visitor benefits from compliance.
• NPS rules can produce a "boomerang effect" of deliberate noncompliance when visitors feel their freedom is threatened.
• When NPS communication is addressed to a group, the effectiveness of messages intended to deter noncompliance will be enhanced by special efforts to address the message to group leaders or to address all individuals within the group

Source: Vande Kamp et al., 1994a.

Provide signs

Purpose

The purpose of signs as a deterrence and enforcement tactic is to modify the character and intensity of use to alleviate unacceptable impacts to resources and visitor experiences.

Description

Signs, as a management tactic, provide a variety of message contents. Signs may contain humorous messages, messages that appeal to the preservation values of visitors, or messages that threaten undesired consequences for noncompliant behavior. The basic intent of signs is to activate visitor attitudes, visitor awareness of social norms, or visitor fear of the possible consequences of inappropriate behavior.

The use of signs to deter noncompliant behavior and enforce rules and regulations can be considered both a direct and an indirect management tactic. For example, visitors may lack an awareness of what damage their behavior can cause, may be unsure about what the regulations are, or may fail to realize the consequences of their behavior. Signs address noncompliant behaviors directly. They inform visitors about behaviors not allowed and of the possible consequences for engaging in those behaviors. The fundamental purpose for signing is to activate visitor attitudes, norms, values, and beliefs, thus influencing visitor decision making. Whether direct or indirect, signs are an obtrusive management tactic.

Swearingen and Johnson (1994, 1995) emphasize that even when thoughtful communication and visitor education systems are in place, need still exists for deterrence and enforcement efforts, which use signs, barriers, sanctions, and personnel, because there will always be visitors who are not exposed to, or do not heed such messages.

Costs to visitors

Moderate to High. The principle cost to visitors of using signs is that signs may be visually obtrusive and may detract from the naturalness of the scene. Signs also may constrain visitor freedom of choice by notifying them of what they can and cannot do. Costs to visitors can be minimized if signs are made to blend in with their surroundings, are used infrequently and judiciously, and do not contain threatening messages. Even so, the costs of using signs as a management tactic falls disproportionately on visitors who heed the message(s) of the sign.

Costs to management

Moderate. Management costs of using signs to deter noncompliance include the cost of manufacturing, installing, and maintaining them. In addition, there are staff costs in terms of enforcement efforts. However, not every sign is put in place with the intention of actively enforcing the specific regulation or message the sign communicates.

Effectiveness

The ability of signs to deter noncompliant behavior is closely linked to the sign's message. The message must be targeted to the specific behavior that is the source of the unacceptable impacts. The message must also make clear what is or is not allowed, why the behavior is or is not allowed, and what, if any, the consequences are for noncompliance. Signs are more effective if they function to activate attitudes and beliefs visitors already hold, instead of trying to instill new beliefs. To effectively deter noncompliant behavior, managers must address the reason(s) behind the behavior and not just symptoms. Efforts to decrease the incidence of noncompliant behavior by informing visitors of the unacceptable impacts to resources and visitor experiences that noncompliant behaviors cause will succeed only with visitors who hold strong values against causing unacceptable impacts. Noncompliant behavior can be decreased among all visitors by providing evidence that most visitors follow the rules.

In their study of 17,416 visitors at Mt. Rainier National Park, Swearingen and Johnson (1994) found that signs threatening sanctions were more effective than those that simply appealed to preservation values. In fact, the level of noncompliance when the sign conveyed a preservation message was almost twice as high as when the sign conveyed the threat of a sanction.

Dwyer (1992) found a correlation between the attributes of “safe and secure” and “information” in a survey of visitors of the Huron-Manistee National Forests. His work suggests that conveying information about rules and safety requirements can have the added benefit of instilling a sense among visitors that the recreation area is safe and secure.

Selected references

Brown and Hunt 1969; Chavez 1996a,b; Christensen et al. 1992; Cole 1998b; Cole et al. 1997; Cruz and Jiron 1994; Dwyer 1992; Hampton and Cole 1995; Johnson et al. 1994; Johnson and Swearingen 1992; Johnson and Vande Kamp 1996; Martin 1992; McCool and Braithwaite 1992; McCool and Lime 1989; Roggenbuck 1992; Roggenbuck and Ham 1986; Swain 1996; Swearingen and Johnson 1988, 1994, 1995; Vande Kamp et al. 1994; Vander Stoep and Roggenbuck 1996.

Sanction visitors who engage in noncompliant behavior

Purpose

The purpose of sanctions as a deterrence and enforcement tactic is to control the character and intensity of use to maintain acceptable resource and experiential conditions.

Description

Sanctions are punishments or the threat of punishments, which are levied upon visitors who engage in noncompliant behavior. When visitors know that sanctions are a real possibility, they will be more likely to avoid noncompliant behavior either out of a sense of doing what is right or because of a fear of the consequences, or both. Sanctions can be used for such noncompliant behaviors as hiking off-trail, souvenir collecting, harassing or feeding wildlife, littering, parking illegally, carving on trees, pounding nails into trees, cutting live trees, the use of illegal equipment, hunting or fishing out of season or without a license, excessive noise, unauthorized use of a campfire, and entering a park or wilderness area without a permit.

Sanctions directly address the cause of various impacts to resources and visitor experiences. Sanctions compliment regulations. In a sense, sanctions give regulations their "teeth." For example, regulations requiring the use of cookstoves and prohibiting the use of campfires directly addresses resource impacts caused by campfires. Sanctions addressing campfires in prohibited areas can ensure the regulation requiring cookstoves is heeded.

Sanctions for visitors who engage in noncompliant behavior can be considered both a direct and an indirect management tactic. Sanctions address noncompliant behavior directly, in that they represent real consequences for engaging in such behavior. However, like signs, a key purpose of sanctions is to activate visitor attitudes and beliefs either about the noncompliant behavior or about the undesirability of being caught. In this way, sanctions influence the decision-making factors that affect visitor behavior. If the visitor is aware the sanction(s) is in place, then this management tactic becomes highly obtrusive.

Costs to visitors

Moderate to High. Even those visitors who are not "rule-breakers" are likely to be influenced by the heavy-handed atmosphere the threat of sanctions creates. On the other hand, visitors who have experienced an impact (such as littering) in an area they care about, may be relieved to know that sanctions are in place for those who engage in noncompliant behaviors. Once sanctions are imposed, visitors may feel more confident

that the unacceptable impact will decrease, or that perpetrators will be subject to a fine or some other penalty. Costs to visitors are minimized if sanctions are used only for behavior that results in relatively serious impacts.

Costs to management

High. For sanctions to be effective, the threat of the sanction must be perceived as real. Carrying out sanctions requires considerable enforcement effort on the part of park management. But, the NPS loses the equivalent of millions of dollars every year in visitor-caused reparable and irreparable damage. Whatever costs management incurs in their efforts to deter noncompliant behavior is insignificant in comparison (Johnson et al. 1994a,b).

Effectiveness

The effectiveness of messages that threaten sanctions increases if these messages are accompanied by explanations of how visitors benefit from compliance (Vande Kamp et al. 1994a). In addition, the effectiveness of sanctions and other deterrence and enforcement efforts can be hindered by a potential "boomerang effect" where visitors purposely behave in noncompliant ways to show their dissatisfaction with having their freedom curtailed. Often managers may not want to implement sanctions even though the sanctions would result in compliant behaviors. They may not want to implement them because of the adverse effect sanctions have on visitor enjoyment. In a survey of NPS managers, 17 percent of those surveyed indicated a belief that fines were the most effective way to deter noncompliant behavior. In the same survey, 43 percent of managers said they felt the use of sanctions was inappropriate because of the constraints on visitor enjoyment sanctions impose (Johnson et al. 1994a).

In their study of NPS backcountry managers, Marion et al. (1993) found that although the most common response to violations of backcountry regulations was for managers to issue a verbal warning, 30 percent of the parks surveyed issued violation notices with fines to backcountry visitors.

Selected references

Christensen et al. 1992; Johnson et al. 1994a,b; Manning et al. 1996; McCool and Lime 1989; Roggenbuck 1992; Swearingen and Johnson 1994; Vande Kamp et al. 1994a,b.

Provide personnel and law enforcement

Purpose

The purpose of using uniformed personnel as a deterrence and enforcement tactic is to control the character of visitor use to maintain acceptable resource and visitor experience conditions.

Description

The presence of uniformed personnel is one of the most powerful deterrents to noncompliant behavior. Neither signs nor sanctions on their own are as effective as signs or sanctions in combination with a uniformed staff member (e.g., Roggenbuck 1992). Since it generally requires onsite personnel to issue sanctions, the lack of onsite personnel is likely to reduce the effectiveness of the threat of punishment. As with other deterrence and enforcement tactics, the presence of uniformed personnel fulfills a dual function of attitude activation and that of making more salient the fear of the consequences of noncompliance.

The presence of uniformed personnel alone does not directly address the cause of unacceptable resource and visitor experience impacts. If managers have done an effective job of communicating, via signs or various visitor education programs, what is or is not allowed, then the presence of uniformed personnel reminds visitors of existing regulations—and possibly the underlying reasons for those restrictions. The presence of uniformed personnel goes hand-in-hand with both regulations and sanctions. The presence of uniformed personnel makes real the possibility of being punished. Just as sanctions suggests a proportionally greater degree of management concern for a given impact, so too the presence of uniformed personnel alerts visitors that an impact is serious enough to warrant staff attention to prevent it.

The presence of uniformed personnel is an indirect management tactic. One of the major purposes of stationing uniformed personnel at sites where noncompliant behavior may occur is to activate visitor attitudes and beliefs either about the noncompliant behavior or about the undesirability of being sanctioned. In this way the presence of uniformed personnel influences the decision-making factors that affect visitor behavior. In addition, although uniformed personnel can perform a variety of customer service functions that are much appreciated by visitors, as an agent of deterrence and an enforcer they are relatively obtrusive.

Costs to visitors

Low to High. For most visitors the costs of uniformed personnel being present is low, representing little more than a temporary intrusion into their recreation experience. On the positive side, there is a reassuring reminder

that park managers are actively engaged in maintaining resource and visitor experience conditions. Further, many visitors enjoy the opportunity to chat with a park employee and learn more about the area. If visitors are concerned about unacceptable impacts and believe the presence of uniformed personnel is necessary to prevent others from behaving in inappropriate ways, then costs for those visitors will be reduced. However, costs increase if a visitor engages in noncompliant behavior, either intentionally or unintentionally.

Costs to management

Moderate to High. Management costs are primarily for staff. Many parks are understaffed and management may feel that the costs are too high to station employees at all the various trouble spots where noncompliance occurs. Management should keep in mind that in some cases it is the uniform more than the person's actual role as a park employee that serves to deter noncompliant behavior. Thus, uniformed park volunteers can be asked to assist in this role to help reduce costs. In addition, costs are also reduced when park personnel who are part of the enforcement staff assist with other park duties related to providing customer services (e.g., directing visitors to desired destinations, interpreting elements of the biophysical environment). Also, since NPS experiences millions of dollars of reparable and irreparable damage due to noncompliant behavior every year, the costs management incurs in efforts to prevent noncompliant behavior are insignificant in comparison (Johnson et a. 1994a,b).

Effectiveness

The presence of a uniformed employee was shown to be effective at deterring noncompliant behavior at Mt. Rainier National Park. Research demonstrated a high degree of effectiveness associated with the presence of uniformed personnel. Researchers speculate the presence of uniformed employees also may create a salient reminder of appropriate behavior (Swearingen and Johnson 1994). If so, the effectiveness of having uniformed personnel at sites prone to noncompliant visitor behavior could be attributed in part to the ability of uniformed personnel to activate attitudes the visitors already have, or to instill a heightened fear of the consequences of noncompliance. As with other tactics, effectiveness is likely to increase if visitors know why specific behaviors are prohibited or discouraged.

In a study at Mt. Rainier National Park, more than 17,000 visitors were observed under a variety of sign, barrier, personnel, and control conditions. One of the more significant findings of the study was that signs threatening sanctions were much more effective than signs that appealed to visitor preservation values. Perhaps the most significant study finding was that

noncompliance all but disappeared in the presence of a uniformed employee (Johnson and Swearingen 1992; Swearingen and Johnson 1994, 1995).

In their 1991 survey of NPS backcountry managers, Marion et al. (1993) found that of the possible actions managers can take to enforce backcountry regulations, the most common response was to give a verbal warning (63 percent). However, 19 percent of managers surveyed indicated they issue written notices without fines, and 30 percent indicated they issue violation notices with fines. Since a high proportion of backcountry violations were resolved with a simple verbal warning, this suggests that managers believe such staff/visitor communications have an acceptable level of efficacy. As such, managers try to avoid issuing written violation notices and/or levying fines when possible, perhaps to avoid potential negative impacts on visitor experience.

Selected references

Chavez 1996a,b; Cole 1989; Johnson and Swearingen 1992; Lime 1979; Manning et al. 1996; Marion et al. 1993; McCool and Lime 1989; Roggenbuck 1992; Swearingen and Johnson 1994, 1995.

Visitor Education

educate visitors about appropriate behaviors

educate visitors to alter use patterns

Visitor Education

The purpose of visitor education is to influence visitor behavior, as well as contribute to positive visitor experiences. Specifically, visitor education is intended: (1) to encourage visitors to practice low impact and other (socially) acceptable behaviors, (2) to reduce human-caused resource problems such as litter, vegetation trampling, improper disposal of human body waste, tree damage, and contamination of lakes and streams, and (3) to alter visitor use patterns spatially and temporally throughout park areas in an effort to reduce use as well as help visitors attain desired experiences for encountering other people. Visitor education programs may be mandatory or voluntary, informal or formal, costly or inexpensive, and may cover a wide range of topics.

Visitor education is about managers providing visitors with opportunities to learn about a large number of topics, including:

- recreational opportunities provided
- environmental conditions in an area
- geomorphological formations found at a particular site
- management actions undertaken in an area and the reason(s) for them
- visitor use levels and patterns of use
- climate and climate change
- rules and regulations in the area
- minimum impact behavior for visitors
- wildlife species and their habitats
- vegetative communities
- ecological processes
- visitor safety concerns
- appropriate visitor social behavior
- ecosystems and their functions
- environmental values and philosophies of the managing agency
- cultural and historical artifacts and traditions specific to an area

Visitor education is an important management tactic for addressing unacceptable impacts to resources and visitor experiences as it can help reduce noncompliant behavior, relieve visitor conflicts, distribute use, and promote resource-friendly behavior. Managers engage in visitor education by communicating messages designed to initiate or activate norms about appropriate visitor behavior; thus motivating visitors to behave in a manner conducive to maintaining acceptable resource and social conditions. For these behaviors to occur, two important conditions must be met. First, visitors must regard the behavior advocated by park managers as personally desirable (Swearingen and Johnson 1994). Second, important messages must be communicated so they facilitate visitor acceptance. The

latter is particularly true when communicating regulations and other “do's and don'ts.”

Hultsman et al. (1987) stress that information should be presented so visitors regard it as helpful as opposed to restraining. For example, to motivate visitors to comply, they suggest using such phrases as “we request visitors' cooperation with . . . .”

Some studies have shown success in reducing noncompliant behavior through threats of sanctions (e.g., Swearingen and Johnson 1994). Exactly what causes a message to be accepted remains unclear, though. Vander Stoep and Roggenbuck (1996) indicate that a number of factors influence the outcome of visitor education efforts, including:

- message channel (e.g., radio, television, newspaper)
- method of presentation
- presenter characteristics (gender, personality, and attire)
- message receiver/audience characteristics (previous experience, beliefs, and values)
- source of the information
- amount of information presented
- how convincing the message is
- message timing

Factors contributing to the success or failure of visitor education efforts are complex, though not necessarily hard to predict. Based on research efforts of Vander Stoep and Roggenbuck (1996) and Doucette and Cole (1993), a set of visitor education guidelines is suggested (table 7).

Some managers suggest communication techniques are not as effective as more heavy-handed approaches to resolving unacceptable impacts to resources and visitor experiences. As indicated earlier, in some cases, threats of sanctions are more effective than preservation appeals. But, the added measure of effectiveness of the more heavy-handed tactics is likely obtained at the expense of the quality of visitor experiences. In any case, it does not have to be an “either/or” situation. Visitor education by itself may not eliminate unacceptable impacts to resources and visitor experiences. But when used with other management tactics, education fulfills an important function.

The visitor education tactics discussed in this section of the handbook are:

- educate visitors about appropriate behaviors
- educate visitors to alter use patterns

Table 7. Guidelines for visitor education activities.

Message Content: • The content of education programs should be guided by specific objectives. • Messages should be relevant to the user/community group. • Messages should include descriptions of management problems, cost and other impacts of the problems (particularly as directly related to the target visitor/community group).
Message Presentation: • Messages should be presented in a positive, respectful way which allows people to take responsibility (rather than feeling dictated to or that their freedom of choice is removed). • Messages should be clear, concise and consistent. • Messages should be presented in a professional manner.
Message Targeting: • Messages should be targeted to specific audiences. • Youth should be a primary targeted group. • Direct involvement of targeted park visitor/user groups, and local community groups, should be incorporated with information dissemination that promotes a sense of ownership, responsibility, and commitment.
Message Timing: • The timing of educational messages is important; that is, whether visitors receive educational messages while planning a park visit, soon after arrival on site, or after engaged in a particular activity. • Message effectiveness tends to increase if it takes place during the planning stages of a recreation activity and/or prior to participation in the activity (Lime and Lucas 1977).
Location of Message Presentation: • Communication strategies should occur both on-site and in outreach settings since repetition and varying contexts help reinforce messages.
Message Effectiveness: • All of the following components of communications influence effectiveness: message content, message channel, characteristics of message receiver, credibility and characteristics of message source, when an individual receives a message. • A combination of techniques is likely to be most effective. Creative ways of educating visitors should be explored. • Personnel must be committed to visitor education efforts.

Source: Vander Stoep and Roggenbuck (1996) and Doucette and Cole (1993).

Educate visitors about appropriate behaviors

Purpose

The purpose of educating visitors about appropriate behavior is to modify the character of use to eliminate unacceptable impacts to the resource and visitor experience.

Description

Doucette and Cole (1993) identify at least 25 methods managers may use to communicate educational and informational messages about appropriate visitor behaviors. The most common of those methods is signs, informational brochures, videos, visitor center displays, and informal communication between park staff and visitors. Although most efforts to educate visitors regarding appropriate behavior have been based on instilling a park or wildland ethic in visitors, a more broad-based ethic about how visitors can and should interact with natural and cultural areas is appropriate for visitor education programs in frontcountry areas, too.

Educating visitors about appropriate behavior directly addresses the cause of some kinds of unacceptable resource and visitor experience impacts. For example, littering, hiking off-trail (especially in sensitive environments), and cutting live trees are unacceptable resource impacts. Education that attempts to persuade visitors not to engage in such resource damaging practices directly addresses the cause of the impacts. Unacceptable visitor experience impacts might include large noisy groups of visitors in backcountry areas who diminish other visitors opportunities to experience solitude. Education informing visitors about the importance of traveling in small groups, keeping noise levels to a minimum, and preserving an acceptable distance between hiking parties directly addresses the cause of the impacts (Hampton and Cole 1995; Swain 1996).

Education about appropriate visitor behaviors is successful when visitors understand why managers promote specific behaviors and why managers have taken specific actions to ensure visitors engage in specific behaviors. Information about management actions directed toward appropriate behaviors educates visitors about the causes of specific unacceptable impacts and motivates them to act in prescribed ways. An exception to the previous statement is when visitors encounter evidence that other visitors are or have engaged in behaviors not supported by management. For example, if visitors see litter on the ground, they are more likely to litter than if they see no litter on the ground. Similarly, if visitors see others hiking off-trail, they are likely to hike off-trail.

Education tactics, education about appropriate visitor behavior is an indirect and subtle management tactic. It is indirect in that it attempts to

influence the decision factors that motivate visitors to behave in one way or another. Although it is subtle, visitors who already engage in appropriate behaviors, may feel that education about how they should behave is unnecessary and may view this type of education as obtrusive. Visitor compliance is enhanced if visitors know why managers implement a particular regulation and if visitors believe that abiding by the regulation will result in acceptable resource conditions and quality recreation experiences.

Costs to visitors

Low. Cole et al. (1987) maintain that the only cost that visitors bear is the time spent in the educational process. Furthermore, they suggest this cost is more than compensated for by the increased pride, appreciation, and understanding visitors receive as they learn to modify their behavior to reflect preservation values better and to minimize unacceptable impacts. To the extent that visitors not only know why a management action was taken, but also are convinced the action will resolve problems, they are likely to comply with it.

Costs to management

Low to moderate. Costs to management include the financial expense of preparing educational literature or developing presentations, as well as the staff time and effort required to ensure the message is reaching and is adequately understood by the target audience. There also are management costs in evaluating whether the educational material is accomplishing the goals and objectives for which it was developed.

Effectiveness

The effectiveness of educating visitors about appropriate behaviors varies from person to person. Frequently, it is contingent upon specific situational factors or constraints. Educating visitors about appropriate behavior will be more effective when visitors: (1) are highly motivated to change their behavior to protect the biophysical environment, (2) are motivated to adjust their behavior so it better reflects values toward natural and cultural areas they already hold, and (3) understand the reason for the management action. Less motivated individuals, however, will likely change some of their behaviors over time if they have been exposed to well-constructed and well-presented educational messages. This possible delay in visitor response to educational messages, though, limits the effectiveness of this tactic in the short term. If the level of noncompliant behaviors remains high in the short term, managers are left with no choice but to implement regulations and begin enforcement efforts.

In their survey of NPS backcountry managers, Marion et al. (1993) found that 77 percent of managers surveyed have a minimum impact education program in place for backcountry visitors. The most common means of educating visitors were informal park ranger contacts with visitors and producing and distributing minimum impact literature to visitors. Many parks also provided low impact programs to local school outdoor education groups and community organizations when requested.

Selected references

Chavez 1996a,b; Cole 1989b; Cole 1998; Cole et al. 1987; Cole et al. 1997b; Doucette and Cole 1993; Doucette and Kimball 1990; Fazio 1979; Hammit and Cole 1998; Hampton and Cole 1995; Higgins 1992; Kernan et al. 1995; Manning et al. 1996; Marion et al. 1993; Martin and Taylor 1981; Roggenbuck 1992; Roggenbuck and Ham 1986; Roggenbuck et al. 1982; Sieg et al. 1998; Swain 1996; Swearingen and Johnson 1994; Vander Stoep and Roggenbuck 1996.

Educate visitors to alter use patterns

Purpose

The purpose of providing visitors with education to alter use patterns is to modify the character and intensity of use to eliminate unacceptable impacts to the resource and visitor experiences. This tactic can result in redistributing visitor use both spatially and temporally throughout the park area as well as to areas away from the park.

Description

Use conditions often vary considerably over a park landscape. Certain sites attract large numbers of visitors, while other areas see relatively little traffic. In addition, areas vary in terms of the resource and visitor experience conditions visitors can expect to encounter. Some resource areas may be pristine while other areas may be developed and exhibit impacts to trails, campsites, cultural resources. Furthermore, other variables such as type of use, behavior of visitors, and group party size may differ on an area by area basis. When managers provide information on use conditions to visitors, visitors make better choices about how to meet their recreational objectives. Moreover, visitor expectations for an area will be more in line with actual conditions when they have advance information about the area.

In addition to information about use conditions, managers might want to encourage visitors seeking specific types of experiences to use specific areas of the park where they are most likely to have the experiences they desire. Or, they might want to encourage visitors wanting to engage in specific kinds of activities to use specific areas of the park where they will be able to enjoy their desired activities. Encouraging or discouraging certain kinds of use throughout the park or in specific areas of the park can result in fewer visitor conflicts and less resource damage.

Managers might also want to use education to encourage or discourage use at specific times. For example, during spring, when many wildlife species breed and raise offspring, wildlife is particularly susceptible to human encounters. Therefore, managers might want to discourage visitor use in some areas during spring. Similarly, in some areas, severe winters may cause some animals to become weakened. Thus, managers may want to discourage use of key winter habitat areas for these animals. In addition, spring soil conditions are generally moist and vegetation is beginning its annual growth cycle. Activities such as hiking generally cause greater soil and vegetative impacts during spring than during other seasons. Therefore, managers may want to educate visitors about recreational impacts during resource sensitive times to discourage use and reduce resource impacts.

Sometimes managers may not want to encourage or discourage all types of use in an area. They may want to discourage selected uses in an area. When use is not encouraged or discouraged unilaterally, managers should educate visitors about their reasons for selectively encouraging or discouraging specific uses. For example, managers may separate different types of activities such as horseback riding and hiking. Visitors need to know that these uses are provided for separately because they conflict with one another causing unacceptable impacts to visitors experiences.

When park managers provide education and information on use conditions to visitors, they directly address the cause of problems. For example, informing visitors of the number of other visitors they are likely to encounter if they visit a particular area at a particular time directly addresses a crowding cause—lack of information on the part of visitors about the number of other people using an area when they want to use the area. Informing visitors about use conditions is an indirect management tactic that influences the decision-making factors affecting behavior rather than the behavior itself. In addition, informing visitors about use conditions is a subtle management tactic in that visitors are more likely to perceive the information provided as helpful rather than constraining.

Costs to visitors

Low to moderate. Informing visitors about use conditions allows them to match their desired experiences with areas in the park where they are most likely to attain those experiences. For example, visitors may wish to visit key attraction sites, but also wish to avoid crowds. If the information on use conditions covers off-peak periods, these visitors may be able to shift their use of times to relatively low use, and thus meet their recreational objectives.

If information on use conditions is provided to visitors during the planning stages of their trip, costs to visitors decrease considerably (e.g., Lime and Lucas 1977; Lucas 1981; Roggenbuck 1992). Costs to visitors increase if information provided is inaccurate, or is presented in such a way as to exert undue influence on visitor decisionmaking.

Costs to visitors increase when managers do not provide an adequate explanation regarding why visitation is encouraged or discouraged in specific areas of the park or at certain times. If attractive alternatives are not provided, or if following management recommendations leads to a recreational experience that does not meet visitor expectations, costs to visitors increase. In addition, if some visitors are discouraged from visiting areas they really want to visit, then the costs fall disproportionately on visitors who voluntarily comply with management recommendations.

As with other nonregulatory management tactics where there is no required procedure the visitor must follow, the burden of this management tactic falls on visitors who are concerned enough about resource and visitor experience impacts that they willingly shift their park visit to times and places of decreased resource susceptibility. Thus, a strong emphasis on visiting during off-peak times and in less used areas may leave these visitors feeling constrained in their leisure choices.

Costs to visitors may also increase when managers restrict some activities parkwide or within specific areas of a park. For example, when managers discourage the use of motorized vehicles because of resource impacts they might cause, increased conflict, hostility, and defensive attitudes on the part of visitors may result. Managers can decrease the likelihood of these behaviors occurring by giving visitors of restricted or prohibited activities adequate opportunity to be involved in decisions concerning their recreational activities.

Costs to management

Low to Moderate. The primary costs to management are: (1) staff time required to monitor use conditions, (2) compilation and updating of information about use conditions, (3) communication of information about use conditions to the public, and (4) costs of developing and printing educational literature used to disseminate this information. In some cases there may be enforcement or infrastructure costs associated with the use of this tactic. For example, restricting or prohibiting specific activities may require some level of enforcement. When enforcement is required, costs to management can be high.

Effectiveness

This tactic is effective at distributing use spatially and temporally and encouraging or discouraging specific kinds of activities. To the extent that managers clearly communicate the reason behind their visitation recommendations, effectiveness will be enhanced. In their survey of Ozark National Scenic Riverway visitors, Anderson and Foster (1985) confirmed that many visitors changed their behavior as a result of perceived changes in the environment. The most common change identified was to reschedule the time of their visit to coincide with nonpeak times of the day, week, or year. Although this time-based change of schedule was not necessarily initiated by information or recommendations supplied by managers, it demonstrates the potential of this visitor education tactic to assist managers in their efforts to redistribute use.

This tactic increases in effectiveness if visitors have information about use conditions during the planning stages of an upcoming trip. It is during trip

planning that future visitors decide when and where to go. In part, the effectiveness of this tactic lies in its ability to make a positive contribution to visitor decisionmaking efforts. As Lime and Lucas (1977) point out, information seems to be a highly desirable visitor management technique. It is nonauthoritarian and can serve visitor desires rather than restrict or regulate them.

This tactic also is effective at modifying visitor expectations regarding the resource and social conditions they will encounter at various places within the park. In this way, the discrepancy between what visitors expect to find and what they actually find can be minimized and visitor satisfaction increased. Even so, the capacity of visitors to adapt to existing use conditions is limited, and information on use conditions will only go so far to boost visitor satisfaction. There is a point beyond which advance information will not be able to compensate for conditions encountered, and visitor satisfaction will suffer.

Selected references

Anderson and Foster 1985; Brown and Hunt 1969; Cole et al. 1987; Krumpe and Brown 1982; Lime and Lucas 1977; Lucas 1981; Manning et al. 1996; Marion et al. 1993; McLean and Johnson 1997; Roggenbuck 1992; Roggenbuck and Berrier 1981, 1982; Sem and Vogt 1997; Vander Stoep and Roggenbuck 1996.

Literature Cited

Literature Cited

Andersen, C. G., and D. W. Lime. 1984. Boundary Waters Canoe Area-Quetico Provincial Park: An international partnership. *Western Wildlands* 10(2):13-19.

Anderson, D. H., and D. I. Foster. 1985. Perceived change in a river environment and its effects on visitor use: A case study of Ozark national scenic riverways. *Western Wildlands* 11(2):21-24.

Anderson, D. H., and M. J. Manfredo. 1986. Visitor preferences for management actions. In *Proceedings--National Wilderness Research Conference: Current Research*, 314-19. Fort Collins, CO: USDA--Forest Service, Intermountain Research Station.

Beardsley, W.G., R. B. Herrington, and J. A. Wagar. 1974. Recreation site management: How to rehabilitate a heavily used campground without stopping visitor use. *Journal of Forestry* 72(5):279-81.

Behan, R. W. 1974. Rationing wilderness use: An example from the Grand Canyon. *Western Wildlands* 3(2):23-26.

Brown and Hunt. 1969. The influence of info-signs on visitor distribution and use. *Journal of Leisure Research* 1(1):79-83.

Brown, P. J., B. L. Driver, and C. McConnell. 1978. The opportunity spectrum concept and behavioral information in outdoor recreation resource supply inventories: Background and application. In *Integrated inventories of renewable natural resources: Proceedings of a workshop*, tech. coords. G. H. Lund, et al., 73-84. General Technical Report RM-55. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Brown, P. J., S. F. McCool, and M. J. Manfredo. 1987. Evolving concepts and tools for recreation user management in wilderness. In *Proceedings-National Wilderness Research Conference: Issues, state-of-knowledge, future directions*, 320-46. General Technical Report INT-220. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Buist, L. J., ed. 1981. *Recreation use allocation*. Nevada Agricultural Experiment Station Publication R-149. Reno, NV: University of Nevada-Reno.

Bury, R. L., and C. B. Fish. 1980. Controlling wilderness recreation: What managers think and do. *Journal of Soil and Water Conservation* 35(2):90-93.

Byrne, W. D., and E. J. Schumm. 1995. Transportation issues in national parks. Paper presented at 1995 Trends in Outdoor Recreation and Tourism Symposium, May 14-17, 1995, St. Paul, MN. Submitted to *Institute of Transportation Engineers Journal*.

Canon, L. K., S. Adler, and R. E. Leonard. 1979. Factors affecting dispersion of backcountry campsites. Research Note NE-276. Broomall, PA: USDA Forest Service, Northeastern Forest Experiment Station.

Chavez, D. J. 1996a. Mountain biking: Direct, indirect, and bridge building management styles. *Journal of Park and Recreation Administration* 14(4):21-35.

Chavez, D. J. 1996b. *Mountain biking: Issues and actions for USDA Forest Service managers*. PSW-RP-226. Albany, CA: USDA Forest Service, Pacific Southwest Research Station.

Christensen, H. H., D. R. Johnson, and M. H. Brookes, tech. coords. 1992. *Vandalism: Research, prevention, and social policy*. General Technical Report PNW-GTR-293. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Cicchetti, C. J., and V. K. Smith. 1973. Congestion, quality deterioration, and optimal use: Wilderness recreation in the Spanish Peaks Primitive Area. *Social Science Research* 2:15-30.

Cole, D. N. 1981. Managing ecological impacts at wilderness campsites: An evaluation of techniques. *Journal of Forestry* 79(2):86-89.

Cole, D. N. 1987. Research on soil and vegetation in wilderness: A state-of-knowledge review. In *Proceedings—national wilderness research conference: Issues, state-of-knowledge, and future directions*, July 23-26, 1985; Fort Collins, CO, comp. R. C. Lucas, 135-77. General Technical Report INT-220. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Cole, D. N. 1989a. The Grand Canyon of the Colorado: A challenge to float, a challenge to manage. *Western Wildlands* 15(3):2-7.

Cole, D. N. 1989b. *Low-impact recreational practices for wilderness and backcountry*. General Technical Report INT-265. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Cole, D. N. 1989c. Wilderness campsite monitoring methods: A sourcebook. General Technical Report IN-259. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Cole, D. N. 1994. Backcountry impact management: lessons from research. *Trends* 31(3):10-14.

Cole, D. N. 1995. Wilderness management principles: science, logical thinking or personal opinion? *Trends* 32(1):6-9.

Cole, D. N. 1997. Recreation management priorities are misplaced—allocate more resources to low-use wilderness. *International Journal of Wilderness* 3(4):4-8.

Cole, D. N. 1998. Written Appeals for attention to low-impact messages on wilderness trailside bulletin boards: experimental evaluations of effectiveness. *Journal of Park and Recreation Administration* 16(1):65-79.

Cole, D. N., and J. Dalle-Molle. 1982. *Managing campfire impacts in the backcountry*. General Technical Report INT-135. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Cole, D. N.,T. P. Hammond, and S. F. McCool. 1997a. Information quantity and communication effectiveness; low-impact messages on wilderness trailside bulletin boards. *Leisure Sciences* 19:59-72.

Cole, D. N., M. E. Petersen, and R. C. Lucas. 1987. *Managing wilderness recreation use: Common problems and potential solutions*. General Technical Report INT-259. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Cole, D. N., and B. Ranz. 1983. Temporary campsite closure in the Selway-Bitterroot Wilderness. *Journal of Forestry* 81:729-32.

Cole, D. N., A. E. Watson, T. E. Hall, and D. R. Spildie. 1997b. *High-use destinations in wilderness: Social and biophysical impacts, visitor responses, and management options*. Research Paper INT-RP-496. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Cole, M. L. 1989. Troubled waters: User conflicts on the Snake River of Hells Canyon. *Western Wildlands* 15(3):8-13.

Cordell, H. K. 1981. Pricing for allocating low-density recreational use between private and commercial users of natural areas. In *Recreation use allocation: Proceedings of the national conference on allocation of recreation opportunities on public land between the outfitted and nonoutfitted publics*, April 3-5, 1981, Reno, NV, ed. L. J. Buist, 77-103. Publication R-149. Reno, NV: University of Nevada-Reno, Nevada Agricultural Experiment Station.

Cruz, P. E., and T. Jiron. 1994. Chetco wild and scenic river analysis of public use. In *Rivers without boundaries: Proceedings of the second biannual ARMS symposium on river planning and management*, April 18-22, 1994, Grand Junction, CO, 181-202. Missoula, MT: American River Management Society.

Deblinger, R. D., Vaske, J. J., and M.P. Donnelly. 1989. Integrating ecological and social impacts into barrier beach management. In *1989 Proceedings-Northeastern recreation research symposium*, 49-56. General Technical Report NE-132. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station.

Doucette, J. E., and D. N. Cole. 1993. *Wilderness visitor education: Information about alternative techniques*. General Technical Report INT-295. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Doucette, J. E., and K. D. Kimball. 1990. Passive trail management in northeastern alpine zones: A case study. In *1990 Proceedings—Northeastern recreation research symposium*, 195-201. General Technical Report NE-145. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station.

Driver, B. L., and P. J. Brown. 1978. The opportunity spectrum concept and behavioral information in outdoor recreation resource supply inventories: A rationale. In *Proceedings of integrated inventories of renewable natural resources*, tech. coords. G. H. Lund et al., 23-31. General Technical Report RN-55. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Dustin, D. L., and L. H. McAvoy. 1984. The limitation of the traffic light. *Journal of Parks and Recreation Administration* 2:28-32.

Dwyer, J. F. 1992. Customer evaluation of campground management: Huron-Manistee national forests. In *Proceedings--1992 Northeastern recreation research symposium*, 87-89. General Technical Report NE-176. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station.

Echelberger, H. E., R. E. Leonard, and S. P. Adler. 1983. Designated-dispersed tentsites. *Journal of Forestry* 81(2):90-91, 105.

Fazio, J. R. 1979. Agency literature as an aid to wilderness management. *Journal of Forestry* 77(2):97-98.

Fazio, J. R., and D. L. Gilbert. 1974. Mandatory wilderness permits: Some indicators of success. *Journal of Forestry* 72(12):753-756.

Fogg, G. E. 1981. *Site planning and design criteria for recreation facilities*. Washington, D.C.: National Recreation and Park Association.

Frost, J. E., and S. F. McCool. 1988. Can visitor regulations enhance recreational experiences? *Environmental Management* 12(1):5-9.

Gale, F. 1985. Monitoring visitor behavior at rock art sites. *Rock Art Research* 2(2):112-17.

Gale, F., and J. Jacobs. 1987. *An overview and evaluation of visitor management strategies for cultural heritage sites*. Special Australian Heritage Pub. Services no. 6, chapt. 6. Canberra: Australian Heritage Commission.

Gilbert, G. C., G. L. Peterson, and D. W. Lime. 1972. Towards a model of travel behavior in the boundary waters canoe area. *Environment and Behavior* 4(2):131-57.

Glass, R., and T. More. 1992. *Satisfaction, valuation, and views toward allocation of Vermont goose hunting opportunities*. Research Paper NE-668. Radnor, PA: USDA Forest Service, Northeast Forest Experiment Station.

Graefe, A. R., F. R. Kuss, and J. J. Vaske. 1990. *Visitor impact management: The planning framework*, vol. 2. Washington, D.C.: national Parks and Conservation Association.

Gramann, J. H., and G. A. Vander Stoep. 1987. Prosocial behavior theory and natural resource protection: A conceptual synthesis. *Journal of Environmental Management* 24:247-57.

Hammit, W. E., and D. N. Cole. 1998. *Wildland recreation: Ecology and management*. 2d ed. New York: John Wiley.

Hampton, B., and D. Cole. 1995. *Soft paths*. 2d ed. Harrisburg, PA: Stackpole Books.

Hanna, N., and H. R. Dodge. 1995. *Pricing: Policies and procedures*. Washington Square, NY: New York University Press.

Hendee, J. C., G. H. Stankey, and R. C. Lucas, eds. 1990. *Wilderness management*, 2d ed., rev. Golden, CO: North American Press.

Heywood, J. 1985. Large recreation group and party size limits. *Journal of Park and Recreation Administration* 3(2):36-44.

Higgins, H. C. 1992. Rock art vandalism: Causes and prevention. In *Vandalism: Research, prevention and social policy*, tech. coords. H. H. Christensen, D. R. Johnson, and M. H. Brookes, 221-32. General Technical Report PNW-GTR-293. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Hof, M., and D. W. Lime. 1997. Visitor experience and resource protection framework in the National Park System: Rationale, current status, adn future direction. In *Proceedings—Limits of acceptable change and related planning processes: Progress and future directions*; May 20-22, 1997, University of Montana; compilers, McCool, S. F., and D. N. Cole, 29-33. General Technical Report INT-GTR-371. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Hultsman, J., R. L. Cottrell, and W. Z. Hultsman. 1987. *Planning parks for people*. State College, PA: Venture Publishing.

Hultsman, W., and J. Hultsman. 1989. Attitudes and behaviors regarding visitor-control measures in fragile environments: Implications for recreation management. *Journal of Park and Recreation Administration* 7(3):60-61.

Johnson, D. R., J. C. Rugh, M. E. Vande Kamp, and T. C. Swearingen. 1994a. Minor violations, major damage: A survey of noncompliant visitor behavior and managerial practices. *Park Science* 14(3):6-7.

Johnson, D. R., and T. C. Swearingen. 1992. The effectiveness of selected trailside sign texts in deterring off-trail hiking at Paradise Meadows, Mt. Rainier National Park. In *Vandalism: Research, prevention, and social policy*, eds. H. H. Christensen, D. R. Johnson, and M. H. Brookes, 103-20. General Technical Report PNW-GTR-293. Portland OR: USDA Forest Service, Pacific Northwest Research Station.

Johnson, D. R., and M. E. Vande Kamp. 1996. Extent and control of resource damage due to noncompliant visitor behavior: A case study from the U.S. national parks. *Natural Areas Journal* 16(2):134-41.

Johnson, D. R., M. E. Vande Kamp, and T. C. Swearingen. 1994b. *A survey of park managers' perceptions of noncompliant visitor behavior causing resource damage in the national park system.* Technical Report NPS/PNRUW/NRTR-92/07. Seattle, WA: USDI National Park Service, Cooperative Park Studies Unit, College of Forest Resources, University of Washington.

Kernan, A., and E. Drogin. 1995. The effect of a verbal interpreteive message on day user impacts at Mount Rainier National Park. In *Proceedings of hte 1994 Northeastern recreation research symposium*; April 10-12, 1994, Saratoga Springs, NY, 127-29. General Technical Report NE-198. Radnor, PA: USDA Forest Service, Northeast Forest Experiment Station.

Knopf, R. C. 1982. Management problems in river recreation: What river floaters are telling us. *Naturalist*. 33(2):12-15.

Knopf, R. C., and D. W. Lime. 1984. *The national river recreation study: An aid to recreation management*. General Technical Report NC-222. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.

Krumpe, E. E., and P. J. Brown. 1982. Redistributing backcountry use through information related to recreation experiences. *Journal of Forestry* 80:360-64.

Lee, G. 1991. *Rock art and cultural resource management*. Calabasas, CA: Wormwood Press.

Liddle, M. 1997. *Recreation ecology*. London: Chapman & Hall.

Lime, D. W. 1972. *Large groups in the Boundary Waters Canoe Area—their numbers, characteristics, and impact.* Research Note NC-142. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.

Lime, D. W. 1976. Principles of recreational carrying capacity. In *Proceedings of the Southern states recreation research*; Sept. 15-18, 1975, Asheville, NC, 122-34. General Technical Report SE-9. Asheville, NC: USDA Forest Service, Southeastern Forest Experiment Station.

Lime, D. W. 1979. Carrying capacity. *Trends* 16(2):37-40.

Lime, D. W., D. H. Anderson, and S. F. McCool. 1978. An application of the simulator to a river recreation setting. In *Simulation of recreational use for park and wilderness management*, eds. M. Shechter and R. C. Lucas, 153-74. Resources for the Future. Baltimore/London: The Johns Hopkins University Press.

Lime, D. W., and M. S. Lewis. 1997. *Reactions of campers and interest group representatives to a proposed camping use fee in the Boundary Waters Canoe Area Wilderness: Results of a 1997 study*. St. Paul, MN: University of Minnesota, College of Natural Resources, Department of Forest Resources.

Lime, D. W., and R. C. Lucas. 1977. Good information improves the wilderness experience. *Naturalist* 28:18-20.

Lime, D. W., S. F. McCool, and D. P. Galvin. 1995. Trends in congestion and crowding at recreation sites. In *Proceedings of the Fourth International Outdoor Recreation and Tourism Trends Symposium and the 1995 national Recreation Resource Planning Conference*, May 14-17, 1995, St. Paul, MN, comp. J. L. Thompson, D. W. Lime, B. Gartner, and W. M. Sames, 87-96. St. Paul, MN: University of Minnesota, College of Natural Resources and Minnesota Extension Service.

Lucas, R. C. 1981. *Redistributing wilderness use through information supplied to visitors.* Research Paper INT-277. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Lucas, R. C. 1982. Recreation regulations--when are they needed? *Journal of Forestry* 80(3):148-51.

Lucas, R. C. 1983. The role of regulations in recreation management. *Western Wildlands* 9(2):6-10.

Lundgren, A. L., ed. 1996. *Recreation fees in the National Park Service—issues, policies and guidelines for future action.* St. Paul, MN: Cooperative Park Studies Unit, Department of Forest Resources, and Tourism Center, Minnesota Extension Service, University of Minnesota.

Manning, R. E. 1979. Strategies for managing recreational use of national parks. *Parks* 4(1):13-15.

Manning, R., E. Callinan, H. Echelberger, E. Koenemann, and D. McEwen. 1984. Differential fees: Raising revenue, distribution demand. *Journal of Park and Recreation Administration* 2:20-38.

Manning, R. E., N. L. Ballinger, J. Marion, and J. Roggenbuck. 1996. Recreation management in natural areas: Problems and practices, status and trends. *Natural Areas Journal* 16(2):142-46.

Manning, R. E., and M. Smith. 1992. The environmental significance of historical parks: A study of evolving park values. In *1992 Proceedings-Northeastern recreation research symposium*, 75. General Technical Report NE-176. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station.

Marion, J. L. 1991. *Developing a natural resource inventory and monitoring program for visitor impacts on recreation sites: A procedural manual*. Natural Resources Report NPS/NRVT/NRR-91/06. Denver, CO: U.S. Department of the Interior, National Park Service.

Marion, J. L., J. W. Roggenbuck, and R. E. Manning. 1993. *Problems and practices in backcountry recreation management: A survey of national park service managers*. Natural Resources Report NPS/NRVT/NRR-93/12. Denver, CO: USDI, National Park Service, Natural Resources Publication Office.

Marion, J. L., and T. Sober. 1987. Environmental impact management in a wilderness area. *Northern Journal of Applied Forestry* 4:7-10.

Martin, B. H., and D. T. Taylor. 1981. *Informing backcountry visitors: A catalog of techniques*. Boston: Appalachian Mountain Club.

Martin, D. C. 1992. The effect of three signs and a brochure on visitors' removal of pumice at Mount St. Helens. In *Vandalism: Research, prevention, and social policy*, eds. Christensen, H. H., D. R. Johnson, and M. H. Brookes, 121-31. General Technical Report PNW-GTR-293. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

McAvoy, L. H., and D. L. Dustin. 1983. Indirect versus direct regulation of recreation behavior. *Journal of Park and Recreation Administration* 1(3):12-17.

McCool, S. F. 1977. Perspectives on managing the off-road recreation vehicle. *Western Wildlands* 4(2):26-31.

McCool, S. F., and A. M. Braithwaite. 1992. Persuasive messages and safety hazards in dispersed and natural recreation settings. In *Influencing human behavior: Theory and applications in recreation, tourism, and natural resources management*, ed. M. Manfredo, 293-326. Champaign, IL: Sagamore Publishing.

McCool, S. F., and N. A. Christensen. 1996. Alleviating congestion in parks and recreation areas through direct management of visitor behavior. In *Crowding and congestion in the National Park System: Guidelines for management and research* , ed. D. W. Lime, 67-83. MAES Misc. Pub. 86-1996. St. Paul, MN: Department of Forest Resources and Minnesota Agricultural Experiment Station, University of Minnesota.

McCool, S. F., and D. N. Cole, compilers. 1997. *Proceedings—Limits of acceptable change and related planning processes: Progress and future directions*; May 20-22, 1997, University of Montana. General Technical Report INT-GTR-371. Odgen, UT: USDA Forest Service, Intermountain Resaerch Station.

McCool, S. F., and D. W. Lime. 1989. Attitudes of visitors toward outdoor recreation management policy. In *Outdoor recreation benchmark 1988: Proceedings of the National Outdoor Recreation Forum*, Tampa, FL, January 13-14, 1988, comp. A. H. Watson, 401-11. General Technical Report SE-52. Asheville, NC: USDA Forest Service, Southeastern Forest Experiment Station.

McCool, S. F., S. R. Martin, and M. Yuan. 1990. The 1989 bear trap canyon visitor study. Institute for Tourism and Recreation Research, Research Report 13. Missoula, MT: School of Forestry, University of Montana.

McCool, S. F., and J. Utter. 1981. A process for allocating public recreation resources. In *Recreation use allocation: Proceedings of the national conference on allocation of recreation opportunities on public land between the outfitted and nonoutfitted publics*, April 3-5, 1981, Reno, NV, ed. L. J. Buist, 60-76. Publication R-149. Reno, NV: University of Nevada-Reno, Nevada Agricultural Experiment Station.

McEwen, D., and S. R. Tocher. 1976. Zone management: Key to controlling recreational impact in developed campsites. *Journal of Forestry* 74(2):90-93.

McLean, R. J., and R. C. A. Johnson. 1997. Techniques for rationing public recreation services. *Journal of Park and Recreation Administration* 15(3):76-92.

Morton, P. A. 1997. Sustaining recreation resources on the southern Appalachian national forests. *Journal of Park and Recreation Administration* 15(4):61-78.

Peterson, G. L. 1983. Rationing and redistribution of recreational use of scarce resources with limited carrying capacity. In *Recreation planning and management*, eds. S. R. Leiber and D. R. Fesenmaier, 286-302. State College, PA: Venture Publishing.

Peterson, G. L. 1992. Using fees to manage congestion at recreation areas. In *Park visitor research for better management*, proceedings of a workshop at the Department of Leisure Studies, Phillip Institute of Technology, Melbourne, Australia, June 24-26, 1992, collator, E. Hamilton-Smith, 57-68.

Peterson, G. L., J. S. deBettencourt, and P. K. Wang. 1977. A Markov-based linear programming model of travel in the Boundary Waters Canoe Area. In *Proceedings: River recreation management and research symposium*, January 24-27, 1977, Minneapolis, MN, 342-50. General Technical Report NC-28. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.

Peterson, G. L., and D. W. Lime. 1979. People and their behavior: A challenge for recreation management. *Journal of Forestry* 77(6):343-46.

Robinson, G. O. 1975. *The Forest Service: A study in public land management*. Baltimore: The Johns Hopkins Press.

Rogers, M. P. 1987. The president's commission on Americans outdoors looks at public-private partnerships. *Trends* 24(3):19-22.

Roggenbuck, J., D, Williams, and C. Bobinski. 1992. Public-private partnerships to increase commercial tour guides' effectiveness as nature interpreters. *Journal of Park and Recreation Administration* 10(2):41-50.

Roggenbuck, J. W. 1992. Use of persuasion to reduce resource impacts and visitor conflicts. In *Influencing human behavior: Theory and applications in recreation, tourism, and natural resources management*, ed. M. Manfredo, 149-208. Champaign, IL: Sagamore Publishing.

Roggenbuck, J. W., and D. L. Berrier. 1981. Communications to disperse wilderness campers. *Journal of Forestry* 79(5):295-7.

Roggenbuck, J. W., and D. L. Berrier. 1982. A comparison of the effectiveness of two communication strategies in dispersing wilderness campers. *Journal of Leisure Research* 14(1):77-89.

Roggenbuck, J. W., O. F. Hall, and S. S. Oliver. 1982. *The effectiveness of interpretation in reducing depreciative behavior in campgrounds*. final Report PO:DACW-39-81-M-2264. Blacksburg, VA: Department of Forestry, Virginia Polytechnic Institute and State University.

Roggenbuck, J. W., and S. H. Ham. 1986. Use of information and education in recreation management. In *A literature review, the President's Commission on Americans Outdoors*, Management:59-71. Washington, D.C.

Roggenbuck, J. W., and R. M. Schreyer. 1977. Relations between river trip motives and perception of crowding, management preference, and experience satisfaction. In *Proceedings: River recreation management and research symposium*, 359-64. General Technical Report NC-28. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.

Rosenthal, D. H., J. B. Loomis, and G. L. Peterson. 1984. Pricing for efficiency and revenue in public recreation areas. *Journal of Leisure Research* 16(3):195-208.

Rutledge, A. J. 1986. *Anatomy of a park*. 2d ed. New York: McGraw Hill.

Schomaker, J. H., and R. C. Knopf. 1985. Recreation management on rivers: The consumers' reaction. *Western Wildlands* 11(2):17-20.

Schreyer, R. 1977. Restricting recreational use of wildlands: Lessons from whitewater rivers. *Western Wildlands*. 4(2):45-52.

Schultz, J., L. McAvoy, and D. Dustin. 1988. What are we in business for? *Parks and Recreation* 23(1):52-53.

Sem, J., and C. A. Vogt. 1997. Demarketing as a new communication tool for managing public land use. *Trends* 34(4):21-25.

Sharpe, G. W., C. H. Odegaard, and W. F. Sharpe. 1994. *A comprehensive introduction to park management*. 2d ed. Champaign, IL: Sagamore Publishing.

Shelby, B., M. S. Danley, K. C. Gibbs, and M. E. Petersen. 1982. Preferences for backpackers and river runners for allocation techniques. *Journal of Forestry* 80(7):416-19.

Shelby, B., and T. A. Heberlein. 1986. *Carrying capacity in recreation settings*. Corvallis, OR: Oregon State University Press.

Shelby, B., G. Stankey, and B. Shindler, tech. eds. 1992. *Defining wilderness quality: The role of standards in wilderness management—a workshop proceedings*; April 10-11, 1990, Fort Collins, CO. General Technical Report PNW-305. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Shindler, B, and B. Shelby. 1993. Regulating wilderness use: An investigation of user group support. *Journal of Forestry* 91(2):41-44.

Sieg, G., J. Roggenbuck, and C. Bobinski. 1988. The effectiveness of commercial river guides as interpreters. In *Proceedings of the 1987 southeastern recreation research conference*, ed. Absher, J. D., 12-20. Feb. 18-20, 1987, Asheville, NC. Athens, GA: University of Georgia.

Soderberg, B. A. 1987. *Canoes, computers, and cooperation or high tech tranquility in Minnesota's Boundary Waters Canoe Area Wilderness*. Paper presented at the World Wilderness Congress, September 12-18, Estes Park, CO.

Stankey, G. H. 1973. *Visitor perception of wilderness recreation carrying capacity*. Research Paper INT-142. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Stankey, G. H. 1977. Rationing river recreation use. In *Proceedings: River recreation management and research symposium*, 397-401. Jan. 24-27, 1977, Minneapolis, MN. General Technical Report NC-28. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.

Stankey, G. H. 1979. Use rationing in two southern California wildernesses. *Journal of Forestry* 77(5):347-49.

Stankey, G. H. 1980a. *A comparison of carrying capacity perceptions among visitors to two wildernesses*. Research Paper INT-242. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Stankey, G. H. 1980b Wilderness carrying capacity: Management and research progress in the United States. *Landscape Research* 5:6-11.

Stankey, G. H., and J. Baden. 1977. Rationing wilderness use: Methods, problems and guidelines. Research Paper INT-192. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Stankey, G. H., D. N. Cole, R. C. Lucas, M. E. Petersen, and S. S. Frissell. 1985. *The limits of acceptable change (LAC) system for wilderness planning*. General Technical Report IN-176. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Stankey, G. H., and R. Schreyer. 1987. Wilderness visitor attitudes and behavior: A state-of-knowledge review. In *Proceedings—national wilderness research conference: Issues, state-of-knowledge, and future directions*, July 23-26, 1985, Fort Collins, CO, comp. R. C. Lucas, 246-93. General Technical Report INT-220. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Stohgren, T. J., and D. J. Parsons. 1986. Vegetation and soil recovery in wilderness campsites closed to visitor use. *Environmental Management* 10(3):375-80.

Sullivan, H., ed. 1984. *Visitors to aboriginal sites: Access, control, and management.* Canberra: Australian National Parks and Wildlife Service.

Swain, R. 1996. Leave no trace (LNT): outdoor skills and ethics program. *International Journal of Wilderness* 2(3):24-26.

Swearingen, T. C., and D. R. Johnson. 1988. *An analysis of off-trail hiking in response to selected social control techniques at Paradise Meadows, Mount Rainier National Park.* Subagreement no. 10, Co-op Agreement no. CA-9000-3-004. Seattle, WA: USDI National Park Service, Cooperative Park Studies Unit, College of Forest Resources, University of Washington.

Swearingen, T. C., and D. R. Johnson. 1994. Keeping visitors on the right track: Sign and barrier research at Mount Rainier. *Park Science* 14(4):17-19.

Swearingen, T. C., and D. R. Johnson. 1995. Visitors' responses to uniformed park employees. *Journal of Park and Recreation Administration* 13(1):73-85.

U.S. Department of the Interior, National Park Service. 1994. Report on day-use reservation system issues: Case studies, options, costs, and a development process. Unpublished report prepared for Yosemite National Park.

U.S. Department of the Interior, National Park Service. 1997a *VERP. The visitor experience and resource protection (VERP) framework. A handbook for planners and managers*. Denver, CO: U.S. Department of the Interior, National Park Service, Denver Service Center.

U.S. Department of the Interior, National Park Service. 1997b. *VERP. A summary of the visitor experience and resource protection (VERP) framework.* Denver, CO: U.S. Department of the Interior, National Park Service, Denver Service Center.

Utter, J., W. Gleason, and S. F. McCool. 1981. User perceptions of river recreation allocation techniques. In *Some recent products of river recreation research*, tech. coords. D. W. Lime and D. R. Field, 27-32. General Technical Report NC-63. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.

Vande Kamp, M. E., D. R. Johnson, and T. C. Swearingen. 1994a. *Deterring minor acts of noncompliance: A literature review*. Technical Report NPS/PNRUW/NRTR-92/08. Seattle, WA: USDI National Park Service, Cooperative Park Studies Unit, College of Forest Resources, University of Washington.

Vande Kamp, M. E., D. R. Johnson, and T. C. Swearingen. 1994b. Preventing visitor-caused damage to national park resources: What do we know? What should be done? *Park Science* 14(3):8-10.

Vander Stoep, G. A., and J. W. Roggenbuck. 1996. Is your park being "loved to death?": Using communications and other indirect techniques to battle the park "love bug." In *Crowding and congestion in the National Park System: Guidelines for management and research*, ed. D. W. Lime, 85-132. MAES Misc. Pub. 86-1996. St. Paul, MN: Department of Forest Resources and Minnesota Agricultural Experiment Station, University of Minnesota.

Wagar, J. V. K. 1940. Certified outdoorsmen. *American Forests* 46:490-92, 524-25.

Walsh, R. G. , G. L. Peterson, and J. R. McKean. 1989. The discriminatory impact of recreation price. *Journal of Leisure Research* 21(4):327-47.

Watson, A., and M. Niccolucci. 1995. Conflicting goals of wilderness management: Natural conditions vs. natural experiences. In *Proceedings of the secod symposium on social aspects and recreation research*; Feb. 23-25, 1994, San Diego, CA, 11-15. Albany, CA: USDA Forest Service, Pacific Southwest Research Station.

Wetzel, J. N. 1977. Estimating the benefits of recreation under conditions of congestion. *Journal of Environmental Economics and Management* 4:239-46.

White, C. M. 1993. Fees for outdoor recreation opportunities. In *Proceedings of the 1993 Northeastern recreation research symposium;* 1992 April 18-20; Saratoga Springs, NY, 36-42. Gen. Tech. Rep. NE-185. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station.

White, C. M., M. Cobus, R. E. Manning, J. Seffel, and T. More. 1995. Trends in the economics of sustainable outdoor recreation and tourism: The future of outdoor recreation fees for the public sector. In *Proceedings of the Fourth International Outdoor Recreation and Tourism Trends Symposium and the 1995 National Recreation Resource Planning Conference*, May 14-17, 1995, St. Paul, MN, comp. J. L. Thompson, D. W. Lime, B. Gartner, and W. M. Sames, 285-93. St. Paul, MN: University of Minnesota, College of National Resources and Minnesota Extension Service.

Wikle, T. A. 1991. Evaluating the acceptability of recreation rationing policies used on rivers. *Environmental Management* 15(3):389-94.

Wuerthner, G. 1985. Managing the wild back into wilderness. *Western Wildlands* 11(3):20-24.

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