



SOCIAL SCIENCE RESEARCH REVIEW



VOLUME 2, NUMBER 1 SPRING 2001

Visitor Capacity in the National Park System

*Dr. Glenn E. Haas
Colorado State University*

Abstract

This paper reviews social science research on visitor capacity relevant to units of the National Park System (NPS). Visitor capacity is defined as a prescribed number and type of people that an area will accommodate given the desired natural/cultural resource conditions, visitor experiences, and management program. Some 40 years of scientific investigation illustrate the complexity of the interaction between human use and park resources. This paper provides insights from environmental psychology on person-environment relationships, nine capacity-related research findings, a matrix of NPS studies, and recommendations for a program of research.

Introduction and Scope

Historically, the National Park Service strategy has been to promote and accommodate recreational tourism in order to assure public and political support (Sellars 1997). This strategy has been remarkably successful in endearing the National Park Service in the hearts and minds of the American public. Yet ironically, it is this success that is challenging the agency to establish and implement recreational carrying capacities.

Legislative and national policy guidance on recreational carrying capacity has been evolving in several ways. The National Parks and Recreation Act of 1978

established a statutory requirement that NPS general management plans include carrying capacities for all areas of each park unit. National policy on recreational carrying capacity has been further expanded within the NPS Management Policies and Director's Orders related to planning, baseline inventories, wilderness, transportation, grazing, and tourism. NPS planning processes continue to evolve, such as general management planning, strategic planning, implementation planning, and the Visitor Experience and Resource Protection (VERP) framework. Some park managers have established capacities for parts of their units and for some uses such as aircraft overflights, river boating, mountain climbing, caving, automobile parking, wildlife viewing, interpretive programs, facility developments, and backcountry camping. Biological and social science efforts continue to strengthen the understanding of the interactions between human use and park resources.

Establishing recreational carrying capacities in park units is a work in progress and, as such, it is occasionally useful to assess what has been learned and where we should go. The purpose of this paper is to synthesize the social science literature on recreational carrying capacity in national parks.

The first section of the paper discusses how capacity decisions are made and where social science can be integrated in the different stages of a planning process. The following three sections provide insights from environmental psychology on person-environment relationships, nine capacity-related research findings, a matrix of park studies, and recommendations for a program of research. [Terms that may be unfamiliar to the reader

are highlighted in **boldface** and defined in a glossary at the end of the paper.]

Planning Context

Recreational **carrying capacity** is defined as a prescribed number and type of people that an area will accommodate given the desired natural/cultural resource conditions, visitor experiences, and management program (Haas 1999a). A capacity serves as a trigger or signal that alerts management that other actions may be necessary to sustain the area's resources, visitor experiences, and management effectiveness. Capacities are unfortunately confused with visitor limits or closures, and it is important to understand that a capacity does not itself prescribe any specific management response. It is a useful management tool to assure the protection and enjoyment of **park resources and values** for present and future generations.

Recreational capacity decisions are made within the context of a rational planning process such as NPS general management planning, implementation planning, the VERP process, or other planning processes in accordance with National Environmental Policy Act compliance. Section 8.2.1 of the NPS Management Policies states:

For all areas within a park, superintendents will identify visitor carrying capacities, make implementation commitments, and identify ways in which to address and monitor unacceptable impacts to resources and visitor experiences. Decisions about what kinds and levels of use are acceptable and sustainable for given areas should be made through general management planning. If a general management plan is not current or complete, or if more detailed decision making is required, a carrying capacity process, such as the Visitor Experience and Resource Protection (VERP) framework, should be applied in a separate visitor management plan or amendment to an existing plan. If the time frame for making decisions is insufficient to allow application of a carrying capacity planning framework, then superintendents must make decisions based on the best available scientific and other information. In either case, such planning must be accompanied by appropriate environmental impact analysis, in accordance with Director's Order #12 (NPS 2000).

Planning is a systematic, comprehensive, and integrated decision-making activity. Every public agency has a variety of planning processes to make logical,

trackable, and defensible decisions. The processes are essentially the same, although they vary in terminology, sequence of steps, type and level of analysis, time and effort, and decision-making criteria. All processes address some need or problem, build upon agency mandates and mission, define a future desired condition for resources and opportunities, establish objectives and standards, inventory uses and resources, develop alternative ways to achieve the desired future conditions and opportunities, assess the effectiveness and efficiency of each alternative, implement the alternative which maximizes public benefits, monitor and evaluate, and accommodate change and revisions.

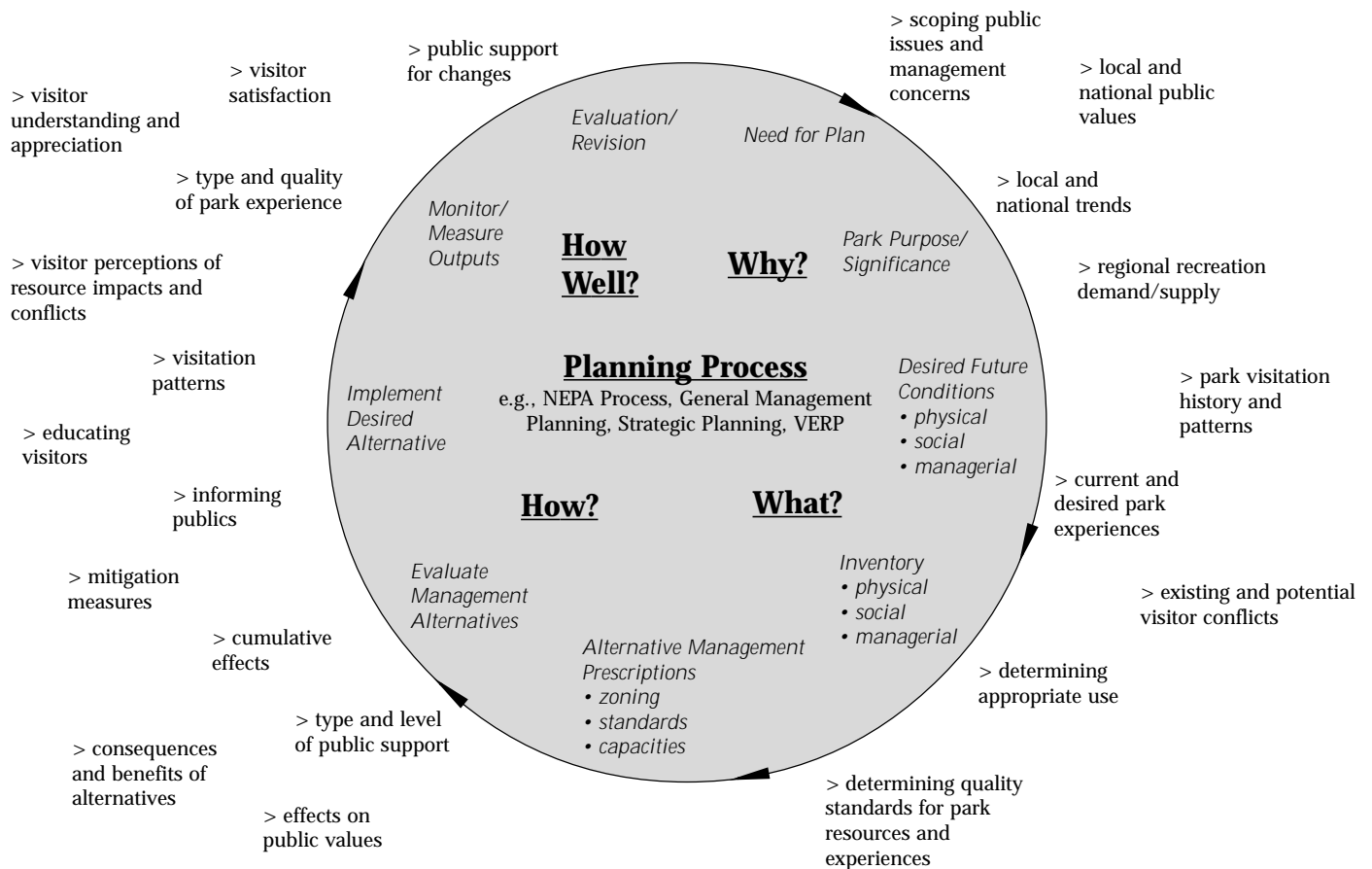
Science is a required input to rational planning and contributes throughout the process. Figure 1 illustrates and serves three purposes. First, it provides a generic planning process and the terminology that is often used in national park planning. A generic process was chosen to make the point that capacity decisions can be made within any rational planning process, and do not require a special or unique set of steps or framework. Second, it identifies where in the process a capacity decision(s) is made. Third, and most importantly for this paper, it conveys that scientific information is vital to decision making and identifies key social variables that are linked to the different steps of the process. Figure 1 is not meant to be exhaustive of all of the inputs to planning, but rather illustrative of key social variables and linkages between science, planning, and capacity decisions.

The Person-Environment Relationship

Recreationists come to national parks seeking a pleasurable **recreation experience**. Visitors experience the physical and social environment encountered and, conversely, they affect the physical and social environment. While the context is different, the much broader and more mature discipline of environmental psychology has focused on person-environment relationships. This section presents some important insights from this theoretical perspective (Bell et al. 1996; Gifford 1997).

Environmental psychology began in the early 20th century in response to industrialization, urbanization, and population growth. It has endeavored to describe

Figure 1. Key Social Science Inputs to Planning Process



the interactions between humans and their environment or surroundings, particularly in the context of urban built environments and issues such as noise, violence, pollution, natural disasters, landscape preference, personal space, and crowding.

Environmental psychology views human functioning as an on-going “collection of clues” gathered by our senses of sight, sound, smell, taste, and touch. These clues are interpreted with the information from past experiences. This functioning (i.e., thoughts, feelings, and behaviors) is a continuance of interactions and adaptations shaped by one’s personal and environmental situation, and interpreted by linking it to past reference points.

An individual brings a host of personal characteristics (e.g., personality, age, gender, ethnicity, goals, intellect, past experience, expectations, beliefs) to an en-

vironment which has physical characteristics (e.g., buildings, weather, open space, vegetation) and socio-cultural characteristics (e.g., people, behaviors, laws, norms, customs, history). Various combinations of these characteristics are the clues by which one interprets and interacts with the surroundings. These person-environment interactions are two-way whereby an individual (or group) can affect the environment and other people and, conversely, the environment and other people can affect the individual (or group).

Another important feature of person-environment relationships is the constancy of change, adaptation, and drive for optimality. Wohlwill (1974) advanced the Adaptation Level (or Optimal Stimulation) Theory of person-environment relations, which is particularly relevant to the experiential nature of outdoor recreation. This theory views humans as transacting through life

seeking a satisfying optimal range of stimulation/arousal, outside of which there is dissatisfaction. The stimulation/arousal is a response to a combination of clues that come from the surrounding physical, social, and managerial environments. When there is too little or too much stimuli (e.g., noise, danger, annoyance, crowding, solitude, anger, elation, boredom, disappointment, confusion, exertion, discomfort, pain), humans activate compensatory measures to reposition themselves back within an optimal range of stimulation/arousal. Examples of compensatory measures include the behavioral responses of avoidance, disengagement, attraction, and confrontation; the cognitive responses of attribution, rationalization, and adaptation; the emotional responses of fear, anger, and happiness; and the physiological response of habituation.

In summary, environmental psychology provides six important insights into how visitors may experience **park settings**:

1. visitors may experience a park using all five senses;
2. a visitor's experience is multi-dimensional and results from a collection of clues gathered by their senses during their visit;
3. a visitor's experience is influenced by their personal characteristics;
4. a visitor's experience is influenced by the park's physical, social, and managerial characteristics;
5. a visitor's interpretation and assessment of their experience is based on the total combination of the clues from their senses; and
6. visitors adapt with their environment towards an optimal range of satisfying stimulation and arousal.

These insights provide a broad theoretical perspective on person-environment relations. Recreation social science and carrying capacity research have focused on some of these insights.

Recreation Research Findings

This section synthesizes social science research on carrying capacity from the outdoor recreation literature. Nine broad research findings are presented to help il-

lustrate that recreational carrying capacity is a prescribed number and type of people that an area will accommodate given the desired natural/cultural resource conditions, visitor experiences, and management program.

1. Capacity defies scientific determinism. There have been many barriers to establishing recreational carrying capacity over the years (Haas 1999b; Loomis 1999b). Perhaps the most lingering and damaging barrier has been the hopeful anticipation that there is a scientific formula to calculate the "magic number" of visitors, and with enough science the answer will be determined. A subtle, yet important, distinction is that one does not determine capacity but rather decides upon it. Science is a vital part of decision making (Figure 1), but it is one input among many that a manager must consider. Figure 2 illustrates other inputs to decision making and the fundamental responsibility of **sound professional judgment**.

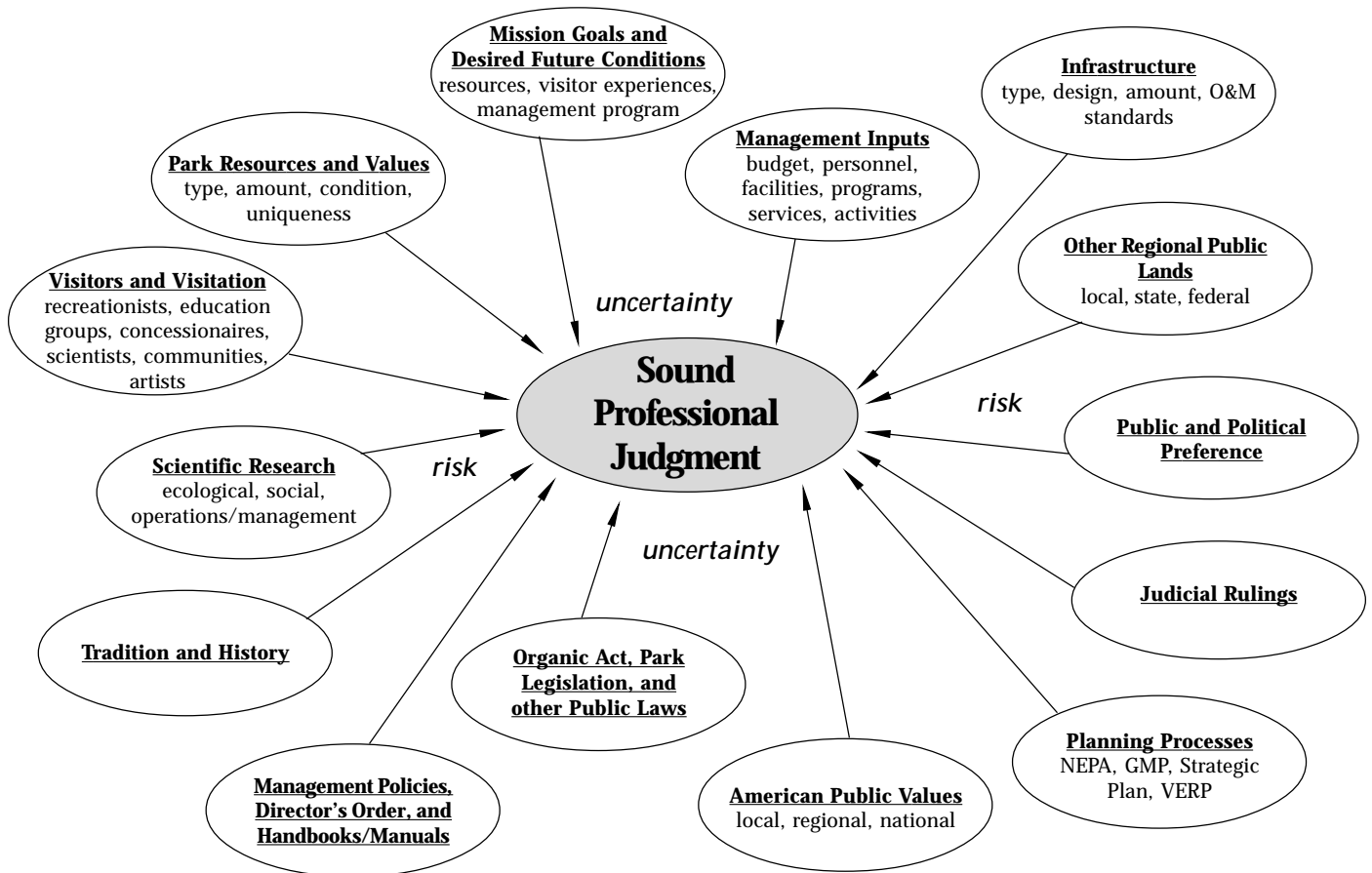
Capacity decisions can be found throughout our everyday lives in industrial and commercial development, land-use zoning, affordable housing, health care, flood control, noise ordinances, K-12 classrooms, military preparedness, water quality, work safety, and welfare (Beatley 1994). Capacities are numerical standards that help to define and assure desired future conditions throughout society.

The recreation research community recognizes that recreational capacity decisions are land-use allocation decisions (Stankey and Manning 1986), and maintains that social science will continue to make vital contributions to the understanding and implementation of capacity decisions (Lime 1996). Such contributions are illustrated in the subsequent findings.

2. Public values are diverse and go beyond recreation. The vast majority of carrying capacity research related to national parks has focused on recreationists and the value of parks for recreational purposes. Yet, capacity planning must consider all the people that use and value an area. A park will have a variety of other users such as educational groups, scientists, artists, concessionaires, local communities, park personnel, and distant people who have an affinity for the park.

The National Parks Conservation Association has been helpful in identifying the multiple values for parks

Figure 2. Information Inputs to Sound Professional Judgement



held by Americans (Haas and Boston 1998; Vaske et al. 1996). Studies have shown that Americans highly value park areas for their protection of wildlife habitat, air and water quality, natural sounds, culture and history, historic buildings and sites, the option for research and scientific study, the provision of income for tourism industry, and the provision of **recreation opportunities**. Furthermore, Americans rated recreation opportunities as less important than they did the protection of water, air, wildlife, natural ecosystems, and the options for our future generations. Haas et al. (1986) also found this latter point to be the case among on-site wilderness backpackers.

The functional planning approach of formulating plans for each resource and program (e.g., water, wild-

life, timber, law enforcement, maintenance, interpretation, fire, wilderness, recreation) is being guided by more integrative, comprehensive, and NEPA-compliant planning. As such, deciding upon recreation capacities independent of other human uses of a park is not adequate. Furthermore, deciding upon desired future conditions and quality standards based solely on input from on-site recreationists, and not inclusive of other users, is not adequate.

3. Recreation experiences are multi-dimensional. An early critical advance made by social scientists was in expanding the concept of outdoor recreation from simply a specific recreation activity to include a **recreation setting** and recreation experience (Burch 1969; Driver and Tocher 1970; Hendee 1974). This conceptual advancement redefined recreational activities

and settings as the inputs or “means to an end,” with the outputs being a recreational experience or bundle of desired **psychological outcomes** (Driver and Brown 1978). The implication for carrying capacity is to prescribe a number and type of people not simply by a recreational activity, but also by the recreational experience for which the area is being managed.

Over the past 25 years, many researchers have contributed to developing a set of scales to define and measure a recreation experience. These scales are similar to psychological testing instruments used to measure corporate leadership, law enforcement, risk aversion, personality traits, depression, and hundreds of other characteristics.

Driver et al. (1987) reported on the multi-dimensionality of the recreation experience. In their findings across 12 studies, the recreation experience was dissected into specific psychological outcomes including enjoying nature, physical fitness, reducing tension, escaping crowds, meeting new people, outdoor learning, family kinship, physical rest, risk-taking, achievement, sharing with others, and self-introspection. These psychological outcomes vary in importance across recreation activities and settings; some add to satisfaction and some detract from satisfaction (e.g., risk-taking may add to or detract from satisfaction), but all contribute to defining a recreation experience. Additionally, none of the psychological outcomes have been found to be the sole determinant of a quality recreational experience; rather, it is the totality of the multiple dimensions which define the nature and quality of the experience. The recreation experience scales continue to be refined scientifically and validated in numerous studies across a wide variety of activities and recreational settings in America (Manfredo and Driver 1996).

This line of survey research found that recreationists value not only the visual beauty of parks, but also the sounds and smells of nature. Gramann (1999) provides an excellent review validating the importance of natural soundscapes and suggests that the restorative properties on visitor experiences may be significant. Haas and Boston (1998) found that 72% of citizens sampled thought experiencing natural peace and the sounds of nature were “very important” reasons for having national parks.

These findings suggest that a recreation experience

is also a multi-sensory phenomenon, consistent with the environmental psychology literature. How much each of the senses contributes to the recreation experience is not known, but it would seem reasonable to assume that the novelty and pleasantries of an outdoor recreational setting, particularly one in contrast to daily living environments, would arouse multiple senses. Recreation social science needs to consider more than visual clues in the person-environment relation.

Thus, a recreation experience (either expected, desired, or realized) can be defined and measured through psychometric scaling techniques. Each psychological outcome contributes in varying degrees to a recreation experience, may vary in importance across activities and park settings, and the presence or absence of some psychological outcomes may compensate for the presence or absence of others. This research also supports that a visitor’s experience involves multiple senses, and that a capacity decision needs to consider visual attributes as well as auditory attributes (e.g., waterfalls, coyotes, wind, traffic, equipment, music) and olfactory attributes (e.g., prairie sage, balsam fir, ocean breezes, engine exhaust, sanitation facilities, adjacent land uses). A clear and comprehensive definition of the desired recreation experience that a park, or zone within a park, is being managed for is a prerequisite to deciding upon a recreation capacity.

4. Recreationists can be grouped by experiences.

There is a long-standing expression that the average recreationist does not exist (Shafer 1969), and to manage an area for the average recreationist will satisfy no one. In response, a line of research emerged 20 years ago to identify groups or segments of recreationists similar to the market segmentation research used in business marketing and to psychological profiling used in the social wellness profession. By applying the psychological outcome scales referred to in the previous section, activity participants can be segmented into subsets of recreation experience types or groupings. The logic is that by understanding the customer better and the nature of the recreation experience appropriate for the park, managers are able to do a better job in general management planning, inventorying available recreation experience opportunities, defining desired park conditions and standards, selecting management tools,

deciding recreation capacities, monitoring, and **adaptive managing**.

The scientific community has identified different types or groups of wilderness backpackers (Brown and Haas 1980; Haas et al. 1981; Manfredo et al. 1983), fishers (Zwick et al. 1993), crosscountry skiers (Haas et al. 1980), hunters (Brown et al. 1977; Floyd and Gramann 1997), wildlife viewers (Manfredo et al. 1991), climbers (Ewert 1993), state park visitors (McCool and Reilly 1993), and river floaters (Williams et al. 1990). The important point for capacity decisions is that not all backpackers want the same experience, not all hunters want the same experience, not all climbers want the same experience, and so forth.

The experience types are differentiated by how much particular psychological outcomes add to or detract from the experience. For example, while enjoying nature may be a commonly desired psychological outcome, other outcomes will tend to vary across types: physical fitness, skill development, risk taking, learning about nature, teaching and sharing skills, escaping crowds, tranquility, independence, being with friends, meeting new people, and observing others. Tarrant et al. (1999) found that recreation experience types may be further understood by considering the type of trip taken (i.e., guided vs. private trips) and characteristics of the participants (e.g., age, level of experience, level of specialization, ethnicity).

For what type of recreation experiences is a park being managed? The responsibility of the NPS to provide quality recreation experiences has been a vague concept, but can be more clearly defined. It is important to go beyond managing for the average recreationist and decide the appropriate and compatible **park-dependent recreation experiences** to provide. Because different types of recreation experiences will often lead to different capacity decisions, the clarity afforded by this line of research is valuable to making capacity decisions.

5. Social interaction is important for some experiences. Most social carrying capacity literature focuses on understanding the on-site recreation experience. Furthermore, the one dimension of the on-site recreation experience that has received the greatest em-

pirical attention is that of crowding and social interaction.

Dr. Irv Altman (1975), an environmental psychologist and recognized leader in how people socially interact, supported the notion that the person-environment relationship is a dynamic, on-going process by which a person seeks an optimal range of social interaction. Any deviation from this optimum is unsatisfactory. There are times and places where one seeks out social interaction, and times and places where one restricts social interaction. When too much social interaction is experienced, crowding is experienced. Conversely, when there is too little social interaction, isolation is experienced. People are active agents in regulating or optimizing the amount and nature of social interactions through such compensatory strategies as repeat/return, avoidance, shifting, rationalization, attribution, and other behavioral and cognitive mechanisms.

The 1960–70s witnessed an array of studies which validated the social importance of outdoor recreation (Burdge and Field 1972; Cheek 1972; Clark et al. 1971; Field and Wagar 1973; ORRRC 1962). These studies found that social relationships were often an important part of the outdoor recreation experience, both within and between groups. It was suggested that it was socially acceptable to interact with strangers in a leisure setting and that this was a major benefit of outdoor recreation (Field and Wagar 1973). Haas, in a study of national park campground users, concluded that “this [campground] is an atmosphere in which social distinctions are stripped, where anonymity reigns and informality prevails, an atmosphere which would appeal to campers, whom [*sic*] have been described (LaPage 1967) as socially gregarious people” (1977, 46).

Driver et al. (1987) found across 12 wilderness studies that the “average” wilderness visitor reported that meeting new people slightly detracted from the experience. Yet, testing the expression that the average visitor does not exist, Brown and Haas (1980) identified five types of wilderness users visiting the Rawah Wilderness in Colorado. They found that two types of wilderness users (36% of total) thought that meeting/observing others slightly added to the experience, another type (10% of total) thought it moderately detracted, and the remaining two types (54%) thought that it nei-

ther added to nor detracted from their experience. Haas et al. (1980) found that one type of wilderness visitor (20% of total) felt meeting/observing others slightly added to the experience. Manfredo et al. (1983) found that being near considerate people and meeting/observing new people slightly added to the experiences for two of the three types of Wyoming wilderness visitors (75% of the total).

To generalize that social interaction is a negative experience in particular settings or for particular activity participants, or that each contact with another person or group erodes the recreation experience, is questionable. Social interaction can be a valued part of an outdoor recreation experience, even in wilderness settings and among recreational activities that are popularly considered solitude-dependent. Thus, making capacity decisions based on recreational activities (e.g., nature study, backcountry hiking, mountain climbing, caving, boating, coastal wildlife viewing) without examining the recreation experiences within those activities is not adequate.

6. Perceived crowding is a dominant focus. The vast majority of social carrying capacity research has focused on the concept of crowding. This line of research has attempted to link perceived crowding to (a) what personal characteristics people bring to the recreation setting, (b) what situational characteristics influence the on-site experience, and (c) how these experiences are assessed. Several overview publications provide details (Graefe et al. 1984; Kuss et al. 1990; Manning 1999; Manning and Lime 1996; Shelby and Heberlein 1986; Stankey and Lime 1973; Stankey and Manning 1986; Tarrant et al. 1999).

In that carrying capacity is a tool to assure the protection and enjoyment of park resources and values, early research efforts measured "enjoyment" by using the metric of visitor satisfaction. Efforts to link number of visitors (density) to visitor satisfaction found little or no statistical relationship (Graefe et al. 1984; Manning and Lime 1996; Shelby 1980). Thus, the research focus shifted to examining the linkage of numbers of visitors to perceived crowding. Perceived crowding remains the dominant metric in the social carrying capacity literature and, in effect, is a surrogate or proxy measurement for satisfaction and a quality recreation

experience.

Manning and Lime (1996) published a synthesis on crowding in the national parks. Paralleling the environmental psychology model of person-environment relations, they reported on a variety of personal and situational variables found to be linked to perceived crowding, and to subsequent visitor changes or adaptations. Personal characteristics related to perceived crowding included visitor motivation (synonymous to desired and expected psychological outcomes previously discussed), preference for experience type, expectations, past experiences, and norms or personal beliefs about appropriateness. Situational variables linked to perceived crowding included actual number of encounters with others, perceived or reported number of others, mode of travel of groups encountered, size of groups encountered, behavior of others, location of encounters, type of other activities encountered, sense of alikeness with others, sense of disruption, type of park setting, location within park setting, nature of built environment, and evidence of past users or artifacts.

They also supported that recreationists can compensate for crowded conditions by leaving the area (displacement/avoidance), altering or redefining their sense of purpose for the area (product shift), rationalizing or making attribution as to why the crowding situation is the way it is, or habituating to the crowded conditions. Others have validated these coping mechanisms attributable to too many encounters, litter, noise, and resource impacts (Anderson and Brown 1984; Gramann 1982; Hammitt and Patterson 1991; Kuentzel and Heberlein 1992; Shelby and Heberlein 1986).

The dominant approach in the 1980-90s for measuring perceived crowding and acceptable resource change is the normative approach (Shelby and Heberlein 1986; Vaske et al. 1986). Norms are personal beliefs or standards of what is acceptable or appropriate behavior, or conditions that are shared among members of a group. It is generally accepted that recreationists can identify norms, and that their norms may be influenced by personal characteristics brought to the recreation setting as well as those situational characteristics during the on-site experience (Manning and Lime 1996; Tarrant et al. 1999).

In summary, the measurement of perceived crowd-

ing is a popular and useful contribution to understanding social carrying capacity, particularly in park settings and for park experiences where low social interaction is a preferred psychological outcome for a quality experience. Perceived crowding has been found to be a complex phenomenon and cannot be defined solely by the number of visitors in a park. Good progress has been made to identify the variables which may help to understand crowding in a particular park setting.

7. Recreation satisfaction can be measured.

Throughout the public and private sector, the most dominant and traditional metric to measure product and service quality has been consumer satisfaction (Engel and Blackwell 1982). Recreation satisfaction has been found to be a complex psychological phenomenon involving multiple dimensions which can add positively or negatively to overall experience quality (Graefe and Fedler 1986; Vaske et al. 1986; Whisman and Hollenhorst 1998; Williams 1999). Early criticism with the measuring of satisfaction was attributed to the methodological approach of asking people simply to report on their overall satisfaction. This global overall satisfaction approach has given way to assessing satisfaction on multiple dimensions of the experience, with consideration of the mediating effects attributable to the personal characteristics that people arrive with at the park, situational characteristics during the on-site visit, and how visitors assess their experience (Manning 1999).

The measurement of visitor satisfaction is a primary goal as set forth in the National Park Service Strategic Plan. Mission Goal IIa states that “visitors safely enjoy and are satisfied with the availability, accessibility, diversity, and quality of park facilities, services, and appropriate recreational opportunities” (NPS 1996, 23). The goal further sets a quality standard that 80% of the park visitors are satisfied with appropriate park facilities, services, and recreational opportunities. Assessing visitor satisfaction (see Figure 1) is a primary output measure to monitor management programs and for adaptive management, including changes based on new information to desired future conditions and capacities.

8. Management can change recreation capacity.

The research literature has focused on capacities related to natural resources and perceived crowding, with consideration of a park’s management infrastructure, pro-

grams, and services being a separate and subsequent decision. Yet, management experience provides evidence that these management attributes are central to making capacity decisions because they can increase or decrease capacity. Capacity decisions are influenced by all aspects of park operations, such as the type and amount of facilities, available personnel, budget, regulations, fee systems, reservation and permit systems, interpretive and public education programs, operation and maintenance standards, volunteers, concessionaires, and local communities.

Several examples of how management may affect capacities are useful. An effective low-impact education program may increase the capacity in a particular area. A mandatory registration and designated campsite program may increase an area’s capacity. The lack of personnel and monitoring capability may decrease the capacity in a fragile area. A new mass transit system with timed departures may expand capacity while, conversely, the associated lack of parking and sanitation facilities may result in a net capacity decrease. Health and safety regulations on acceptable noise and speed levels may alter capacities for boating on lakes and rivers and for future lodging facilities. Scientific enclosures, no fishing zones, grazing allotments, or special wildlife habitat zones will decrease recreation capacities.

Environmental psychology and recreation research conclude that a person experiences a setting through a combination of its physical, social, and managerial characteristics. Thus, concurrent consideration of the management program during the planning process is equally important and might sometimes be determinant in capacity decisions.

Several studies have made the conceptual and empirical linkage between desired recreational experiences and management preferences (Ballman et al. 1981; Brown and Haas 1980; Brown et al. 1977; Haas et al. 1980; Manfreda et al. 1983; McLaughlin and Paradise 1980). These findings help to validate that concurrent consideration of management actions is important for capacity decisions.

9. Recreation can change resource conditions. A detailed review of the ecological science literature was

beyond the scope of this paper, and there exist substantial literature reviews and bibliographies on recreation interactions with water, wildlife, fisheries, soils, and vegetation (Cole 1987; Ewert 1999; Haas and Boston 1998; Hammitt and Cole 1998; Knight and Gutzwiller 1995; Liddle 1997; Lucas 1987; Marion and Farrell 1998; York 1994). There are, however, several basic social factors and relationships that might be helpful to the reader.

Much like the perceived crowding and satisfaction research, the linkage of levels of use and resource change is equally complex and multi-dimensional. An accepted formula or index is not available which indicates that for X change in recreation use there would be Y change in resource condition.

In the area of recreationally-induced change to soils and vegetation, several social variables are noteworthy. The recreation use-resource change relationship is curvilinear; i.e., the greatest amount of change to soils and vegetation takes place in the early or initial stages of use (e.g., backcountry camping). Other recreational factors found to influence resource change include amount of use, frequency of use, size of groups, length of stay, timing or season of use, and type of campsite infrastructure such as campfires, corrals, benches, and waste disposal.

Likewise, recreation behavior can affect wildlife (York 1994). While there is consensus that humans do affect fish and wildlife, the specific type and amount of positive and negative changes, and the associated benefits and costs, are localized. Social variables affecting these resources have been found to include human sounds, startle effect, size and speed of recreational boats, frequency and regularity of encounters, and time and season of encounter.

Social variables can also influence the effect of recreational uses on water quality, aquatic vegetation, and fisheries. The type, amount, and speed of boats influence the amount, duration, and constancy of wave action on the shorelines, thus increasing erosion, habitat loss, turbidity, and loss of aquatic vegetation. Conversely, these same social variables may improve water quality by oxygenating water and diluting point source contaminants (Wisconsin Department of Natural Resources 1996). Human behavior related to human waste

and unconsumed oil and gas also affect water quality and fisheries.

Social science research has found that the type of recreation use can affect resource conditions. These social factors are important to consider in the planning process (Figure 1) when managers decide upon future desired conditions for the natural resources, visitor experiences, and management program. Because these characteristics of the setting affect one another, it is important that these considerations be concurrent and integrated.

NPS Studies Matrix

The matrix in Table 1 provides an overview for managers of the type and location of carrying capacity studies that have taken place in the National Park System. Virtually every NPS social science research project has implications for carrying capacity and discretion was used as to which studies directly contributed social science insights to carrying capacity decisions. The matrix indicates the recreation sample studied, data collection technique, and findings.

Several points can be drawn from comparisons across the matrix. There was a considerable increase in capacity research activity in park units during the 1990's, yet the overall quantity of capacity research in the National Parks has been very small. The research foci were typically visitor perception of resource change or perception of crowding. The metric of perceived crowding and its norm-based measurement remains popular.

Study samples were almost exclusively of on-site park visitors visiting specific locales during high use summer seasons. Visitors were systematically sampled based on such variances associated with time of day, day of week, mode of travel, size of party, and by other descriptive characteristics. Efforts to distinguish visitors beyond broad activity types and to understand or segment by recreation experience type were few.

Data collection instruments were principally interview and questionnaire survey instruments. The research designs were typically post-hoc or case studies, with few comparison groups, control groups, pre-post test measures, repeated measures, and hypothesis testing.

Table 1: NPS Carrying Capacity Studies Matrix

PARK UNIT	GROUP STUDIED	CONCEPTS STUDIED	METHODS	FINDINGS	CITATION
Yosemite NP	Backcountry users	Crowding	Survey	Perceptions of crowding are found to be linked more closely to desired experiential outcomes, backcountry travel experience, and socio-demographic attributes of visitors rather than to actual use levels.	Absher 1979
Fort Sumter NM	Visitors	Crowding	Self-administered questionnaires	Reported contacts, expectations, and preferences for contacts, behavior of other people, and visitor experience were not significantly related to crowding. Perceived crowding in a built recreation environment was best predicted by density, and expectations and preferences for density.	Andereck 1989
Fort Sumter NM	Visitors	Crowding	Self-administered questionnaires	There was evidence of a carry-over crowding effect from one aspect of a visitor experience to another. Density and perceived crowding during one phase of a recreation experience were directly and indirectly related to expectations and preferences for density and perceived crowding in a second phase of the experience.	Andereck and Becker 1993
Lower St. Croix WSR and Upper Mississippi River	River users	Displacement	On-site questionnaires and interviews	When each of the study rivers was viewed individually, no relationship between density and satisfaction was found. When viewed as a system, however, it was discovered that a proportion of users from the Lower St. Croix River who were sensitive to its high use levels now favored the Mississippi. There appears to be a displacement of users between rivers within a system.	Becker 1981
Mount McKinley NP	Backcountry users	Recreational carrying capacity	Pre-trip and post-trip questionnaires	Density was correlated with contacts and these contacts were related with crowding. Crowding was not shown to be important to hikers' overall satisfaction with their backcountry trips.	Bultena et al. 1981
Cape Lookout Nat. Seashore and Moores Creek National Battlefield	Visitors	Perceptions of park impacts and environmental concern	Mail-back questionnaires	Public perceptions of park impacts are related to an individual's beliefs about the natural environment. Individuals with greater environmental concern were less accepting (or less tolerant) of certain types of park impacts, while individuals with lesser degrees of environmental concern were more accepting of certain park impacts.	Floyd et al. 1997

Table 1: NPS Carrying Capacity Studies Matrix (cont.)

PARK UNIT	GROUP STUDIED	CONCEPTS STUDIED	METHODS	FINDINGS	CITATION
Shenandoah NP	Big Meadows Campground overnight visitors	Social interaction, activity patterns, camping style, and descriptive characteristics	On-site questionnaires	Social interaction occurs in a family campground setting, but neither the level nor the amount of social interaction is related to user descriptive characteristics, except for the length of stay and the distance from the campsite of the person with whom interaction occurs. User-descriptive characteristics are not distinctly associated with activity patterns. In comparing the camping-style user aggregate, the amount and level of interaction and activity patterns are similar; however, the descriptive characteristics, marital status, number of children, life stage, and first visits do significantly differ among the three camping styles.	Haas 1977
Great Smoky Mountains NP	Winter backcountry users	Use patterns, characteristics, experience and motives	Mail-back questionnaires, and use of data from permits	Backcountry permit data indicate that use patterns differ significantly between winter and summer campers, with winter campers taking shorter, weekend, destination-type trips. Winter campers engage in backcountry camping nearly twice as often during winter as other seasons of the year, both in and outside GSMNP. They are also experienced hikers that tend to avoid camping in Great Smoky Mountain National Park during the summer because of heavy visitor use.	Hammitt and Hughes 1984
Great Smoky Mountains NP	Backcountry campers	Coping behaviors	On-site contacts and mail-back questionnaires	Physical coping behaviors were used more commonly than the social behaviors as a mechanism for controlling visitors' interactions and maintaining wildland privacy. Use of physical coping behaviors was more strongly influenced by the importance of wildland solitude and congruent encounter norms. Visitors who had lower encounter norms, and who were more sensitive to actual encounters experienced, participated significantly more often in 10 of the 12 coping behaviors. Level of past experience had little influence on use of coping behaviors.	Hammitt and Patterson 1991
Great Smoky Mountains NP	Shelter campers	Solitude preferences and visitor characteristics	On-site and mail questionnaires	Results indicated that the "typical" shelter user averaged 33 years of age, was college educated, and came from urban areas of nearby states. Eighty-four percent had previous backpacking experience, averaging 6.8 total years of experience. Trips in the study area consisted of 3-day hikes, with 94% of users backpacking less than 5 days. Distance hiked ranged from 3 to 80 miles, and 73% of the parties contained 2-4 individuals. Encounter levels were highest on trails (X= 10.2 parties/trip), with shelter encounters (X= 2.7 parties/trip) being less. A third of users reported that they felt the number of encounters detracted from their solitude experience.	Hammitt and Patterson 1993

Table 1: NPS Carrying Capacity Studies Matrix (cont.)

PARK UNIT	GROUP STUDIED	CONCEPTS STUDIED	METHODS	FINDINGS	CITATION
Acadia NP	Carriage roads	Application of the VERP process	Three phase research program	Steps 1-3 of the VERP process resulted in the statement of purpose and significance of the carriage roads and a map of resources and social conditions of the carriage roads. In step 4, the range of resource and social conditions was narrowed to social conditions only, as no major impacts to natural or cultural resources were identified. In step 5, two zones (peak and nonpeak) of the carriage road system were identified. In step 6, standards were established for the two indicators of quality, crowding and behavior: (1) 80% of visitors will have a high quality experience 90% of the summer season days; (2) the carriage road carrying capacity is 3,000 visitors per day; and (3) standards of quality in the high use zone are no less than 341 minutes at zero, no more than 27 min. at 1-5, no more than 2 min. at 6-10, and no min. at 11 or more. Behavioral standards of quality for the high- and low-uses zone are also discussed. The management actions (Step 9) identified to handle violations of crowding and behavioral standards of quality include visitor education, parking control and mass transit, visitor permits, and more enforcement patrols.	Jacobi and Manning 1997
Mount Rainier NP	Trail users at Paradise Meadows	Effectiveness of social control techniques	Observation and field interviews	Trailside signs reduce noncompliance in comparison to a control (no sign), and different sign texts vary significantly in observed rates of noncompliance. The threatened sanction sign was significantly more effective than any other treatment in reducing off-trail hiking. The sign with the ethical appeal was the next most effective sign, but the rate of noncompliance nearly doubled in comparison with the threatened sanction sign. Noncompliance almost disappears in the presence of a uniformed NPS employee.	Johnson and Swearingen 1992
Banff, Yoho and Kootenay NP (Canada)	Visitors to highway oriented campgrounds	Reaction of people to sounds	On-site questionnaires and interviews	Annoyance is independent of loudness within the range of sound levels studied. Physical characteristics and socio-psychological aspects of the sounds appear to influence the manner in which people evaluate different sounds.	Kariel 1990
Yellowstone NP	Backcountry users	Use of information to redistribute use	Trail-selector map and follow-up questionnaires	Information describing attributes of different trails, and presented as a decision tree, was effective in redistributing backcountry use. Recreationists considered the trail-selector useful.	Krumpe and Brown 1982

Table 1: NPS Carrying Capacity Studies Matrix (cont.)

PARK UNIT	GROUP STUDIED	CONCEPTS STUDIED	METHODS	FINDINGS	CITATION
Apostle Island NL	Boaters	Coping and displacement	Panel study and follow-up questionnaires	Crowding in 1975 did not predict whether or not one would stop boating at the Apostle Islands, and whether one would either change his/her mind about the resource, or change his/her contact expectations and preferences over the next 10 years. Crowding in 1975 did predict redistribution to less popular locations within the Apostle Islands. The crowding scores of those who did not use cognitive coping strategies were not significantly different from those who did.	Kuentzel and Heberlein 1992
Yosemite NP	Backcountry users	Visitor use	On-site questionnaires	Satisfaction of trail users depended on good physical condition of the trails, absence of litter and horse manure, and pleasant social demeanor of other users. Satisfaction of campers depended on non-destructive behaviors of other campers, absence of pack stock and horse manure in the camp area, and a limited number of other campers. Social relationships between groups of campers were more important to satisfaction than the condition of the physical environment. Crowding was less important to visitor satisfaction than perceptions of "alikeness." Amount of horse manure on the trails had a bigger effect on perceived crowding than actual contacts recorded by an observer, and the amount of litter and the evidence of destructive acts also had an effect.	Lee 1975
Arches NP	Park visitors	Relative importance of indicator variables	Personal interviews supplemented by mail-back questionnaires	The number of people at any one time at Delicate Arch is an important indicator variable. A standard of quality of a maximum of 30 people at one time was set for Delicate Arch. Five management actions (e.g., education about appropriate behavior) were generally supported by the visitors.	Lime et al. 1994
Arches NP	Park visitors	Indicators of quality of the visitor experiences	Personal interviews and focus groups	Good information, education, and interpretive facilities and services were often cited as contributing to the quality of the visitor experience, and relatively large numbers of visitors expressed the desire for more programs. Many visitors were concerned with crowding-related issues in the park, a variety of inappropriate visitor activities and behaviors, and resource impacts of public use.	Manning et al. 1993

Table 1: NPS Carrying Capacity Studies Matrix (cont.)

PARK UNIT	GROUP STUDIED	CONCEPTS STUDIED	METHODS	FINDINGS	CITATION
Glacier Bay NP	Tour boat passengers to Grand Pacific Glacier	Norm congruence	On-site and mail-back questionnaires	Examining the sample as a whole, findings suggested that only a relatively small percentage of respondents evaluated the number of watercraft/aircraft seen in a way that was incongruent with data on their personal norms for seeing watercraft/aircraft. These findings were generally consistent over the five types of watercraft/aircraft studied. However, a sub-sample of respondents who saw the same number of watercraft/aircraft as the hypothetical number presented in the questionnaire presented an especially strict test of norm congruence. In this situation, norm incongruence was considerably higher, averaging nearly half of this sub-sample.	Manning, Johnson and Vande Kamp 1996
Acadia NP	Carriage road visitors	Potential indicators of quality and estimation of visitor use	Survey, monitoring and focus groups	Most visitors to the carriage roads enjoy their experience. However, there were growing indications of problems related to crowding (i.e., too many people on the roads) and some user behaviors (i.e., bicycles going too fast). Thus, these problems were selected as the most appropriate indicators of quality for the carriage road visitor experience.	Manning, Negra, Valliere and Jacobi 1996
Acadia NP	Mount Desert Island residents	Standards of quality and displacement	Mail-back questionnaires	Residents reported having adjusted their use of carriage roads substantially because of changes that had occurred on them. Visitors and residents appear to have similar norms, or standards, for crowding; however, residents were much less tolerant of problem behaviors than were visitors.	Manning, Valliere, Ballinger and Jacobi 1998
Acadia NP	Carriage road visitors	Normative standards of quality and visitor use estimation	On-site survey using a visual approach, a computer-based simulation model	The maximum acceptable number of person per-viewscape (PPV) ranged from 11 to 18. Visitors also reported they currently see about 5 PPV, suggesting the carriage roads have not yet reached their carrying capacity with respect to crowding or sheer number of visitors. Numerical standards for the four most important problem behaviors were also developed.	Manning, Valliere, Wang, Ballinger and Jacobi 1998
Acadia NP	Carriage road visitors	Crowding norms	Personal interviews and mail-back questionnaires	There are statistically significant differences between crowding norms derived from the visual and numerical approaches. There is a statistically significant, but relatively small, difference between crowding norms derived from the long and short question formats. The long format resulted in higher crowding norms. The five evaluative dimensions of crowding (i.e., preferences, acceptability, acceptability to others, management action, and absolute tolerance)	Manning et al. 1999

Table 1: NPS Carrying Capacity Studies Matrix (cont.)

PARK UNIT	GROUP STUDIED	CONCEPTS STUDIED	METHODS	FINDINGS	CITATION
Blue Ridge Parkway, Chattahoochee River NRA and Chickamauga and Chattanooga NMPs	Park visitors	Users' perceptions of resource and use impacts	On-site contact cards and mail-back questionnaires	<p>tested differ from one another significantly and often substantively. There appears to be a clear hierarchy of crowding norms among these dimensions that appears intuitively to be meaningful.</p> <p>Park user perceptions and tolerance for situational impacts vary widely among cluster groups of park users, and within changing situations there are degrees of acceptability and unacceptability for an impact. Norms range from a low associated with preferences to a high associated with absolute tolerance. There is an indication that margins of relative differences exist between cluster user groups and how they respond to impact situations.</p>	Noe et al. 1997
Great Smoky Mountains NP	Backpackers	Norm congruence and wilderness solitude	On-site contact cards and mail-back questionnaires	<p>Solitude was important to the wilderness experience of most backpackers in the study. Sixty one percent of study respondents whose personal norms at one or more of the three encounter sites were exceeded by the actual number of encounters indicated that the number of encounters did not detract from their experience.</p>	Patterson and Hammit 1990
New River Gorge NR	River boaters	Encounter norms	On-site and mail-back questionnaires	<p>There is a general lack of river encounter norms and low consensus among norms for most types of experiences in the New River.</p>	Roggenbuck et al. 1991
Grand Canyon NP	River users	Crowding	Observation and on-site questionnaires	<p>Use levels and river encounters had no significant effect on perceived crowding, but encounters at the attraction sites had a small effect. These variables explain about 4% of the variance in perceived crowding. Also, those who said they saw more than they expected or preferred felt much more crowded. Expectations and preference were about six times more important than actual contacts, explaining an additional 25% of the variance in perceived crowding. In other words, the personal psychological standards people brought with them were more important than the actual number of groups met on the river.</p>	Shelby 1976
Grand Canyon NP	Backcountry trip leaders	Expectancy theory	Mail-back questionnaires	<p>Results indicate that 20% of hikers who desired solitude were not fulfilled. There were variations in solitude fulfillment between three distinct backcountry use zones.</p>	Stewart and Carpenter 1989

Table 1: NPS Carrying Capacity Studies Matrix (cont.)

PARK UNIT	GROUP STUDIED	CONCEPTS STUDIED	METHODS	FINDINGS	CITATION
Lower St. Croix NSR	Property owners	Elicitation study (attitudes, behaviors)	Mail-back questionnaires	There are differences between the property owners' patterns of recreational use and the severity of the problems in each zone. In general, residential property owners in all zones tended to support most of the potential management actions suggested for the riverway.	Thompson et al. 1996
Grand Canyon NP	Hikers, trail users	Preferences, users' characteristics and motivations	Mail-back questionnaires	Results indicate overwhelming acceptance of a recently instituted permit and quota system, which severely limits the number of persons using the Grand Canyon trails. Most hikers perceive the inner canyon as a wilderness area, have a keen appreciation of what wilderness should be, and support management policies, which will preserve a wilderness environment.	Towler 1977
Acadia NP	Carriage road visitors	Computer simulation as a tool for describing visitor travel	Visitor census counts, on-site surveys, and geographic information system analysis	Person-per-viewscape (PPV) outputs for different total use level conditions and use zones provide an efficient and sophisticated view of the visitor experience that is directly related to the visual approach for establishing carrying capacity standards of quality. PPV conditions under present-day use do not violate proposed standards of quality. Results show likely PPV conditions under scenarios of increasing use and in different areas within the carriage road system. Findings suggest that computer simulation is useful for estimating current carrying capacity conditions, predicting future conditions, and guiding related research.	Wang and Manning 1999
New River Gorge NR	River users	Norm-encounter compatibility	On-site and mail-back questionnaires	Crowding perceptions, efforts to avoid other users, and type of trip received depend on the degree of norm-encounter compatibility. These relationships were strongest for those who expected a scenic as opposed to wilderness trip. Satisfaction was not related to norm-encounter compatibility. More respondents were classified as having incompatible trips (encounters greater than norm) than rated their trips as crowded or different from their expected trips.	Williams et al. 1991
Katmai NP	Campers	Crowding	On-site questionnaires	The relationship between crowding and density was mediated by density (i.e., preferences and expectations for density), structural factors (i.e., spatial arrangements of camping parties), social behaviors of campers, and the relationship between physical capacity of campgrounds facilities and demand for use.	Womble and Studebaker 1981

Research Recommendations

While the attention given recreational carrying capacity among park and recreational professionals across America has been substantial, the human and financial resources allocated to social carrying capacity research have been small. Thus, as with many young and small scientific endeavors, complexity more than resolution has been the principal finding. Five recommendations for future research direction are offered.

1. Alternative paradigms need to be advanced and debated by the scientific, management, and stakeholder communities. Several considerations are stimulated by this synthesis.

First, a quality recreation experience is a multi-dimensional phenomenon and to use perceived crowding as its proxy may not be sufficient. There are many motivations and psychological outcomes which in combination define the recreation experience. The focus on one dimension, such as perceived crowding, is counter to the multi-dimensionality of person-environment relations. Furthermore, the “perceived crowding” paradigm, while intuitive and having some legislative basis in designated wilderness, is questionable across the full spectrum of park units. There is need to consider the totality of the visitor experience.

Second, a quality recreation experience is a multi-sensory phenomenon and goes beyond the visual clues of the setting. It has become increasingly apparent that natural sounds and smells are an important part of a park experience, and perhaps in some park settings even the sense of taste and touch contribute. Capacity decisions need to consider the appropriateness of activities that impair and enhance the visitor’s senses of nature and culture, and social science needs to be more inclusive of the multiple senses used to shape a recreation experience.

Third, the historic and disciplinary stereotypes that accompany the terminology of carrying capacity and recreational carrying capacity are burdensome. There is a need for a clearer phrase that the public can relate to and a broader concept which can incorporate all the human use and uses in a park setting. The phrase, “**visitor capacity**,” is proposed because “capacity” is a common term that people are familiar with in their everyday lives and it does not hide or mislead the public

from the need for capacities in park units, and because “visitor” reflects the privileged use of park units and goes beyond recreation use to include all human use.

Fourth, a significant amount of time within the scientific community over the last 20 years has been allocated to developing planning processes to address capacity decisions and defining quality resources and experiences. No less than nine planning processes have been published. These processes have been received with varying degrees of institutional acceptance, utilization, funding, training, and implementation. Yet, unfortunately, there is a common management perception that in order to address capacity decisions one of these processes must be used.

A reasonable assumption is that some highly visible and controversial capacity decisions will be litigated based on the lack of procedural or substantive compliance with NEPA. Indeed, NEPA is the national charter for environmental planning and analysis — it can improve decision making, advance scientific understanding, and very importantly to this topic, it can provide judicial deference for administrative decisions such as visitor capacity. The judicial system has made it clear that their role is to assure legal compliance and not to make administrative decisions. Thus, an alternative paradigm is that management addresses major capacity decisions for areas of critical capacity concern (ACC) in the NPS general management plans, United States Forest Service forest plans, Fish and Wildlife Service refuge management plans, and Bureau of Land Management resource management plans. Capacities can easily be written into the management objectives for a park, or areas within, and serve as measurable triggers, signals, and standards.

Fifth, a common perception of the purpose of recreational carrying capacity is that it is a means of imposing limits, closures, and no access to the American public. The phrase has an absolute, regulatory, and negative connotation. An alternative paradigm would have a proactive and positive appeal. It would be helpful to recognize that visitor capacity is a tool to help define and locate appropriate recreation opportunities for the American public that will assure sustaining the area’s resources, values, and opportunities. It would be helpful to recognize that the goal of visitor capacity is to meet the recreational demand of the American public through an in-

tegrated and collaborative supply of opportunities across the spectrum of local, state, and federal lands and waters. Visitor capacity is a measure of supply which allows for the distribution of demand in a sustainable manner.

Sixth, visitor capacity decisions are not static and timeless, but dynamic and interim as new information, science, and circumstances present themselves. Visitors and uses change and new information and technology is ever present. Visitor capacity and adaptive management are two tools which are used together and allow one to capitalize on learning from professional field experiences. Capacity decisions will change based on reasoned and deliberate analysis of what is learned.

2. The shift towards ecosystem management and the seamless delivery of recreation opportunities should prompt consideration to plan and manage at a larger geographic scale than the park unit level. This has appeal because a visitor's "visitation range," much like wildlife and water resources, is often larger than the political boundaries of a park unit or jurisdiction. Interagency regional recreation planning efforts, with adequate supporting scientific study, are needed that (a) go beyond a particular type of recreation activity and setting, (b) clearly define the recreation experiences an area is being managed for, (c) consider the non-recreational users of the area, and (d) integrate concurrent consideration of management characteristics. This might be best accomplished via several large-scale demonstration projects involving multiple jurisdictions.

Stankey and Manning concluded in their summary to the President's Commission on American Outdoors that "perhaps the greatest shortcoming in the research on carrying capacity is the lack of holistic, integrative studies that combine natural resource, social, and managerial perspectives" (1986, 54). This conclusion remains valid today.

3. Social carrying capacity research should incorporate additional research tools such as observation, cognitive and behavior mapping, simulation, participant diaries, focus groups, content analysis, field and lab experiments, formative and summative evaluation, repeated measures, control and comparison groups, and hypothesis testing. The social carrying capacity research has principally used survey research methods (i.e., on-site recreation inter-

views or mail questionnaires) and a post-hoc or case study research design. The environmental psychology field has found merit in expanding to a more multi-method, multi-trait approach to the science of person-environment relations.

Social science could provide management with a valuable service to conduct longitudinal and both formative and summative evaluative research as capacity efforts are being planned and implemented. Brown and Haas (1999), in planning for the 1999 Congress on Recreation and Resource Capacity, compiled a database with 100 state and local parks where managers have established and implemented recreational carrying capacities. Much could be learned from analyzing what managers have learned from their experience. Evaluative research which is integrated early in the planning process or to existing capacity programs is needed for the effective and efficient use of adaptive management.

4. The scientific community needs to help define park recreation experiences and segments of visitors much more substantially in order for managers to make decisions that are rational, defensible, and understood by the public. The most critical management decision point in Figure 1 is the development of the desired future conditions. It is here that managers decide what types of activities and experiences are appropriate and desired. There is a need to move beyond planning and managing for general activities and to move beyond ambiguous experiential phrases.

Social science has determined that recreation experiences are multi-dimensional and that segments of recreationists can be identified and managed for. This added clarity in defining recreation experiences and types of users would help management more clearly define a park's desired future conditions and how to manage its visitors.

5. Inter-agency institutional leadership and coordination should be of paramount importance for capacity planning, management, and research. Recreational capacity is an issue that transcends all public park and recreation agencies in America. It is often a volatile and complex decision that will generate discussions about "recreational rights and takings," and will be shaped by the political system and clarified by the judicial system (Haas 2000; Haas 1999a; Keiter 1999). The more disparate state and federal park agencies are

in their capacity processes, terminology, rationale, science, knowledge, and experiences, the more professional judgment will be replaced by judicial and political decisions. These interventions will be costly in terms of money, time, resource protection, and most importantly, professional morale and confidence.

In 1928, federal and state leaders convened the National Conference on Outdoor Recreation. They formulated the elements of a federal recreation policy which included the following:

The initiation, through inter bureau cooperation, of regional studies and planning to determine the policy which should govern forms of use, occupancy and management which will most completely realize the potential educational, scientific, inspirational and recreational values of the national parks and forests (1928, 140).

In 1962, the Outdoor Recreation Resources Review Commission proposed the following management guideline:

All agencies administering outdoor recreation resources—public and private—are urged to adopt a system of classifying recreation lands designed to make the best possible use of available resources in the light of the needs of people. Present jurisdictional boundaries of agencies need not be disturbed . . .

Implementation of this system would be a major step forward in a coordinated national effort. It would provide a consistent and effective method of planning for all land-managing agencies and would promote a logical adjustment of the entire range of recreation activities to the entire range of available areas (1962, 7).

In 1999, the National Congress on Recreation and Resource Capacity was convened with 25 state and national institutional sponsors. Once again, a major conclusion expressed by leaders of the public land management agencies and special interests groups was the need for a more integrated, comprehensive, regional, intergovernmental, and multi-jurisdictional approach to recreational capacity planning, management, and research (Barry 1999; Bschor 1999; Loomis 1999b; Machlis 1999; Williams 1999).

In partial response, a federal Interagency Task Force on Visitor Capacity on Public Lands was activated in June 2000 by the Department of the Interior. Its pur-

pose is to coalesce interagency professional judgment towards developing a set of capacity principles, decision criteria, and decision-making protocols that would demonstrably assure decisions that are reasoned, deliberate, fair, trackable, and adequate. A similar interagency effort of coalescing expertise is needed to demonstrate the advantage of large-scale regional planning and scientific study.

Conclusion

National park managers are required by law to establish capacities for all parks. These decisions are made as part of a park planning process and incorporate the best available science.

Social science research on recreation carrying capacity is a young field of science and small in terms of the number of scientists and funding. Complexity more than resolution is a predominant finding, with specific “truths” applicable across park visitors and settings remaining illusive. Yet, progress has been made and this synthesis of social research identifies nine general findings that may contribute to improved planning and sound professional judgment:

- capacity defies scientific determinism;
- public values are diverse and go beyond recreation;
- recreation experiences are multi-dimensional;
- recreationists can be grouped by experiences;
- social interaction is important for some experiences;
- perceived crowding is a dominant focus;
- recreation satisfaction can be measured;
- management can change recreation capacity; and
- recreation can change resource conditions.

The National Parks Omnibus Management Act of 1998 includes a mandate for science in the parks and park management. Science is central to recreation capacity planning and management. Much work needs to be done to assure the protection of park resources and values, and the opportunities they afford to the American public and world.

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Glossary

adaptive management: A rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management decisions, objectives, standards, programs and activities.

visitor capacity: A prescribed number and type of people that an area will accommodate given the desired natural/cultural resource conditions, visitor experiences, and management program (Haas 1999a).

park-dependent experience: A particular kind of recreation experience that allows the visitor to experience, understand, and appreciate those resources and values essential for why the park unit was included in the NPS.

park resources and values: The resources and values of a park whose conservation is essential to the purposes for which the area was included in the NPS.

park setting: The combination of all the real and perceived attributes that comprise a park, including its *physical resource attributes* (e.g., water, trees, weather, sounds, geology, historic structures, wildlife), *social attributes* (e.g., recreationists, non-recreational park users, values, pets, behaviors, visitor equipment, litter, human noise, sounds and smells of communities or industry outside the park), and the *management attributes* (e.g., rules, regulations, interpretive programs, services, type and design of facilities, utilities, personnel, signage).

psychological outcomes: The specific mental responses (i.e., feelings, thoughts, beliefs) that a recreationist will obtain from participating in a particular activity in a specific park setting. These outcomes may be considered when deciding what type of recreation opportunity to participate in, or reflected upon when assessing one's satisfaction with the experience.

recreation experience: The psychological and physiological response from participating in a particular recreation activity in a specific park setting.

recreation opportunity: The possibility afforded by managers for the visitor to have a particular kind of recreation experience.

recreation setting: See **park setting**.

sound professional judgment: The moral and intellectual ability to make reasoned decisions based upon careful and due consideration of facts, science, circumstances, assumptions, and inferences of the situation.

Additional Resources

National Park Service Cooperative Park Studies Unit

Department of Forest Resources
Attn: Dr. Dorothy Anderson
University of Minnesota
St. Paul, Minnesota 55108
Phone: (612) 624-2250, FAX (612) 625-5212

Recreation Management Program

School of Renewable Resources
Attn: Dr. Robert Manning
University of Vermont
356 Aiken Center
Burlington, Vermont 05405
Phone: (802) 656-3096, FAX (802) 656-2623
e-mail: rmanning@nature.snr.uvm.edu

1999 Congress on Recreation and Resource Capacity

November 29–December 2, 1999, Snowmass, Colorado. Hosted at Colorado State University and sponsored by some 25 state and national organizations. Many of the papers, authors, and an evolving visitor capacity database can be accessed at www.cnr.colostate.edu/nrrt/capacity/.

Attn: Dr. Glenn Haas, glenn@cnr.colostate.edu

About the Author

Dr. Glenn E. Haas is a professor in the College of Natural Resources at Colorado State University. He is currently (2000-2001) on sabbatical as Advisor to the Assistant Secretary of the Interior for Fish and Wildlife and Parks, and leading the federal Interagency Task Force on Visitor Capacity on Public Lands. His areas of interest include natural resource planning, outdoor recreation management, policy formulation, and public administration. Glenn has worked in the national office of the U.S. Forest Service where he drafted the limits of acceptable change policy and helped advance the recreation opportunity spectrum system; served 10 years as a university department chair; served 4 years on the board of the National Society for Park Resources and 6 years on the board of the National Parks Conservation Association; and was the Co-Chairman of the 1999 National Congress on Recreation and Resource Capacity. He has worked extensively over the last 25 years with state and federal land and water resource agencies. Internationally, Glenn was instrumental in the legislative creation of the Belize Protected Areas Conservation Trust and the Human Dimensions Research Unit in the School of Forestry at Kasetsart University in Thailand. Dr. Haas can be contacted at:

Year 2000-2001

Dr. Glenn E. Haas
Department of the Interior
18th and C Street, NW
MS-MIB-3156
Washington, DC 20240
Phone: (202) 208-6212
FAX: (202) 208-4684
e-mail: glenn.haas@doi.gov

Permanent

Dr. Glenn E. Haas
College of Natural Resources
Colorado State University
Fort Collins, Colorado 80523
Office Phone: (970) 491-5126
Home Phone: (970) 498-9350
FAX: (970) 491-2255
e-mail: glenn@cnr.colostate.edu

Notes

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Dr. Gary Machlis
Visiting Chief Social Scientist
National Park Service
1849 C Street, NW (3127)
Washington, DC 20240
Phone: (202) 208-5391
e-mail: gmachlis@uidaho.edu

