Getting a Handle on Visitor Carrying Capacity – A Pilot Project at Arches National Park

By Marilyn Hof, Jim Hammett, Michael Rees, Jane Belnap, Noel Poe, Dave Lime, and Bob Manning

Annual visitation to national park areas is now counted in the hundreds of millions. In the decade of the 1970s visitation increased by 30 percent; in the 1980s it rose 35 percent. If this trend continues, national park areas can expect a demand for an additional 60-90 million recreation visits by the year 2000. This presents the National Park Service with a huge challenge — maintaining the integrity of park resources and visitors' experiences.

In the past, the question of how much public use is appropriate in a national park has been framed in terms of "carrying capacity." This term/concept has come both from within the Park Service and from Congress —the 1978 General Authorities Act requires each park's general management plan to include "identification of and implementation commitments for visitor carrying capacities for all areas of the unit." Although Park Service management policies and planning guidelines acknowledge this responsibility, there has been little direction or agreement on a methodology for how to identify a park's carrying capacity. Indeed, there has not even been an agency-wide agreement on the meaning of the term "carrying capacity."

For the past several years NPS planners at the Denver Service Center and consultants at University of Minnesota and the University of Vermont CPSUs have been developing a process intended to help park planners and managers address visitor carrying capacity. The rest of this article summarizes this process, called the Visitor Experience and Resource Protection (VERP) process as well as discusses a pilot project at Arches NP.

The VERP Process

VERP defines carrying capacity as: *the type and level of visitor use that can be accommodated while sustaining the desired resource and social conditions that complement the purposes of the park units and their management objectives.*

In other words, the VERP process interprets carrying capacity not so much as a prescription of numbers of people, but as a prescription of desired ecological and social conditions. Measures of the *appropriate conditions* replace the measurements of *maximum sustainable use* that are often used to measure other types of carrying capacities (e.g., range capacity for domestic ungulates, wildlife habitat [Dassmann 1964]).

As conceived, the process will identify and document the kinds and levels of use that are appropriate, as well as where and when such uses should occur. The prescriptions, coupled with a monitoring program, will give park managers the information and the rationale needed to make sound decisions about visitor use, and gain the public and agency support needed to implement those decisions.

As shown in Figure 1, the VERP process consists of nine steps. The first six steps are requirements of general park planning, and ideally should be part of each park's general management plan. The later steps in the process require annual review and adjustment, and are accomplished through park operations and management activities.

The VERP process is based on many of the same elements and underlying logic included in the U.S. Forest Service's limits of acceptable change (LAC) and the National Parks and Conservation Association's visitor impact management (VIM) methodologies (Graefe, et al 1990; Lime and Stankey 1971). The primary difference between

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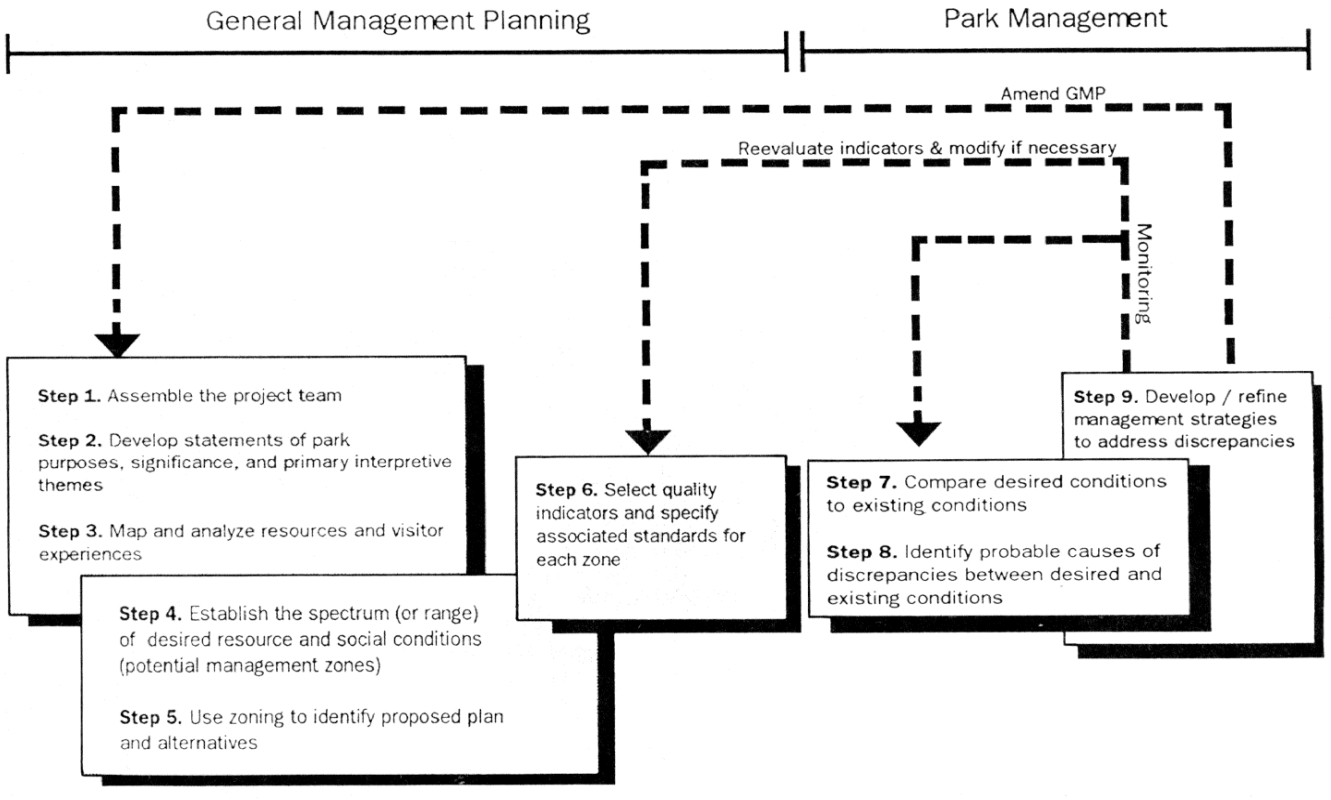
Figure 1. Process for Addressing Visitor Experience and Resource Protection in the National Park System



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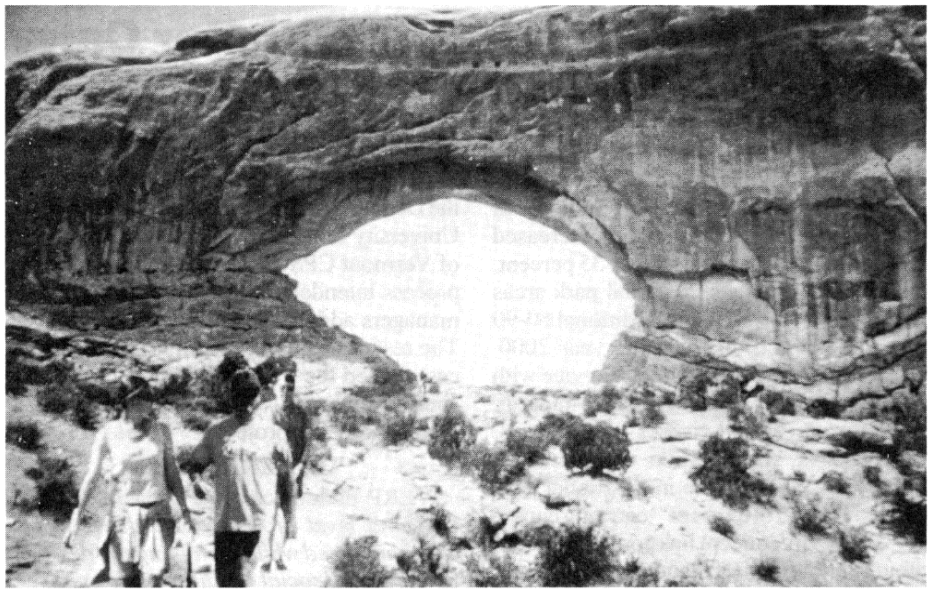

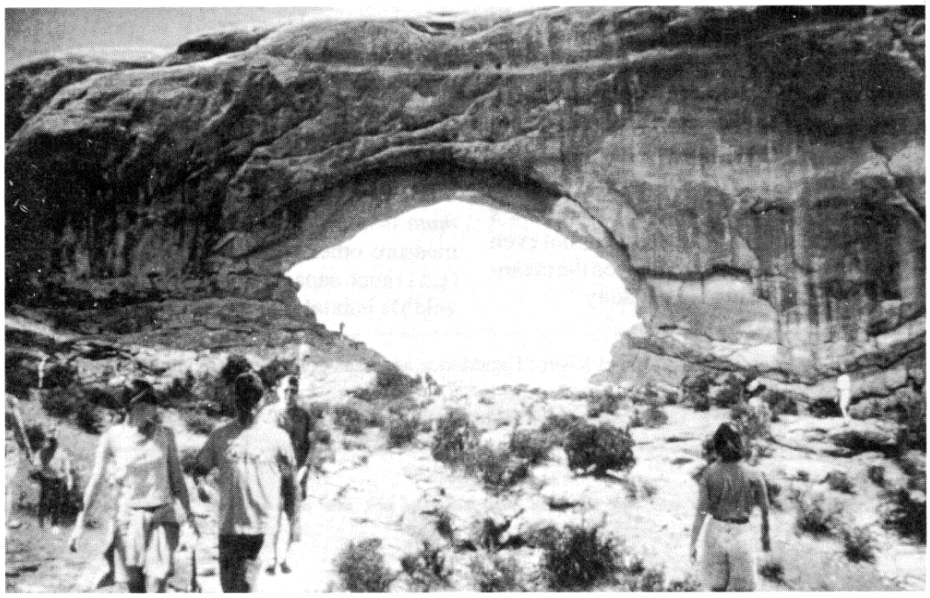

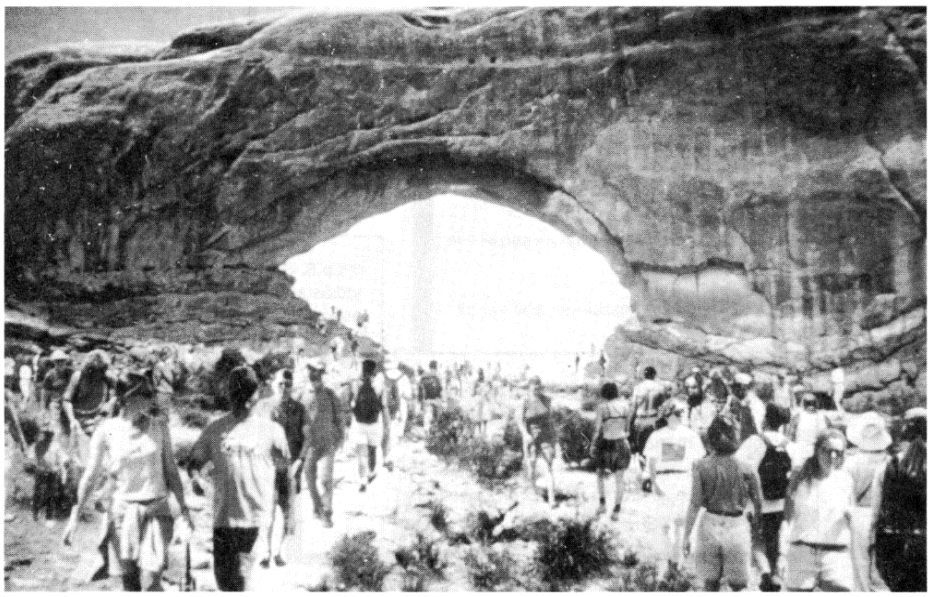

Computer generated photographs showing three levels of social impact.

VERP and these other processes is that VERP is intended to be used in all areas of a park, both frontcountry and backcountry whereas LAC and VIM have primarily been used in wilderness settings.

A major premise of these methodologies and VERP is that management goals, which are qualitative in nature, must be translated to *measurable* management objectives through the use of *indicators and standards*. Measurable indicators will be selected for monitoring key aspects of the visitor experience and resources, then standards will be assigned based upon management goals. When standards are exceeded, land managers must take action to get an indicator back within its defined standard. In a complex park, the park will also be zoned to reflect management goals for different areas. Then, specific indicators and standards would be selected for each zone.

Indicators are divided into two types: *biological/physical indicators*—those indicators that measure impacts to the biological or physical resources of a park; and *social indicators*—those indicators that measure impacts on park visitors that are caused by interactions with other visitors or with park or concession employees.

The underlying logic of indicators is easy to understand; however determining what standard to apply to different parts of the park is not so easy. It requires research, considerable thought, and considerable bravery on the part of managers! Since VERP is driven by indicators and standards, a considerable amount of effort has to be spent determining them.

VERP at Arches National Park

The VERP process is being pilot-tested at Arches NP. The purpose of this test application is to refine the VERP process and to provide a model for application to the National Park System. The process is currently between steps 5 and 6. The park has been zoned and the zones have been qualitatively described. The next step is the selection of corresponding indicators and standards. Below we describe research in progress by the authors aimed at defining these.

Research to Select Biological Indicators

During the past two summers, researchers have been evaluating potential indicators that might be used to measure impacts to park resources from visitor use. Nineteen indicators were evaluated in different habitats along trail corridors with high, moderate, and low use levels. Most of the potential indicators were discarded for a variety of reasons: they

were too difficult to measure, too costly, correlated poorly with changes in visitor use, too dependent on environmental variables such as rainfall, too slow to recover once impacts were reduced, or were not useable in different habitats.

However, three indicators showing considerable promise were selected:

cryptobiotic soil crust condition. This crust, which forms atop nearly all soils on the Colorado Plateau, is very important for nutrient cycling; it is very sensitive to visitor use; is easy to measure and quantify visually; and is indicative of overall ecosystem health.

soil compaction. Despite their sandy nature, soils of the Colorado Plateau are compactable, which adversely affects water uptake, nutrient cycling, and plant germination and growth. Again, this is a very easy indicator to measure and soils here recover from compaction fairly quickly once causal factors are removed.

formation of social trails. This indicator is an effective measure of off-trail use and indicates how much of an area away from designated trails is being trampled by visitors.

In addition to the above first tier indicators, which will be monitored on a weekly or monthly basis, a set of second tier indicators will be measured on a 5-year cycle. These indicators include cover and frequency of vascular plants by species, elemental tissue analysis of dominant plants, cover and frequency of ground cover (litter, cyanobacteria, mosses and lichens), soil characteristics (organic matter, bulk density, porosity, etc.). The purpose of these indicators is to measure more directly the ecosystem health, and also to check the validity and utility of the first tier indicators.

Research to Select Social Indicators

The social carrying capacity research program at Arches was approached in two phases. Phase I was conducted in the summer of 1992 and aimed at identifying potential social indicators (Manning et al. 1993). Personal interviews were conducted with 112 visitors throughout the park. In addition, 10 focus group sessions were held with park visitors, park staff and local community residents.

Phase I research was qualitative in nature; its purpose was simply to explore for potential indicator variables. Additional research, phase II, was needed to become more quantitative by asking respondents to rate the relative importance of these potential indicators. This required a larger and more representative sample. It also required some innovative sampling techniques based on image capture technology (Nassauer 1990, Chenoweth 1990, Pitt 1990, Lime 1990). Base photographs of park sites were taken and these images were then modified with computer software to present a range of impact conditions. A set of 16 photographs was developed for each attraction site and trail presenting a wide-ranging number of visitors present. An analogous set of photographs was developed for a range of environmental impacts caused by off-trail hiking. Respondents rated the acceptability of each photograph.

Data from the second phase of the research program are now being analyzed. Our expectation is that we will be able to identify the most important indicators of quality for each potential zone within the park and will be able to suggest visitor-based standards for at least some of these indicator variables. A program of monitoring will then be needed that focuses on these indicator variables. When monitoring indicates that standards of quality have been reached or exceeded, then carrying capacity will have been reached or exceeded as well.

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Jacksonville Science Conference Proceedings Now Available

Proceedings of the 7th Conference on Research and Resource Management in Parks and on Public Lands, held in Jacksonville, FL Nov. 16-20, 1992, are now available in a single 479-page (softbound) volume for "probably under $20." In addition to all the papers, summaries of the sessions, and a list of poster presentations, the book contains a Preface by William E. Brown, an Introduction to the Conference by Jean Matthews, and Gaylord Nelson's conference closing address.

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Battling Bees Here

An article in the latest *Inside Bajada* by Gloria Maender of the NPS CPSU at U/AZ reports the arrival in at least four NPS sites in Texas of swarms of Africanized honey bees (AHB)—the kind that was introduced into Brazil from South Africa in 1956. In addition to describing the swarms at Big Bend NP, Amistad NRA, Padre Islands National Seashore, and San Antonio Missions NHP, the article describes measures that at-risk NPS units should be taking:

- Become aware of the type of habitats within the park area where honey bees now nest and monitor the bee population.
- Use pheromone-baited swarm traps to monitor feral bees. USDA Agricultural Research Service traps are durable, inconspicuous, and popular with bees.
- Establish and maintain contact with local State Agriculture Department personnel responsible for AHB monitoring and information.
- Establish working relations with federal or UA honey bee research scientists.
- Train at least two personnel in handling of swarm traps and emergency procedures.
- Develop handouts for park visitors, calling on University extension services.