

Limits of Acceptable Change: A Framework for Assessing Carrying Capacity

By Jeffrey Marion, David Cole, David Reynolds

Editor's Note: Following is what promises to be only the first in a continuing series looking at various approaches to a complex set of problems that once were lumped under the heading "carrying capacity." The two "boxes" inserted into this article refer sketchily to other approaches that will be reported in future issues. Park Science welcomes word of any other efforts to deal with this generic problem and any observations from interested readers – either reactions to the published presentations or educated thoughts on the subject.

Increasing recreational use of National Parks is forcing managers to deal more actively with problems of deteriorating resources and recreation experiences. If parks are not managed carefully, the very uses for which they were, in part, created can threaten the environmental integrity and recreational quality of their resources. One concept frequently advanced as a help in managing recreation use and its associated impacts is that of carrying capacity. The concept was

borrowed from range and wildlife management, where it is a measure of the amount of use (in these cases, by animals) that an area of land can support on a sustained basis without destruction of the resource base.

In recreation, it was hoped that similar use limits (carrying capacities) could be set for recreationists, in such a way that quality resources and experiences could be maintained. Although the body of research on carrying capacity is voluminous, very little progress has been made toward realizing this hope. Nevertheless, legislative and agency directives have called for setting carrying capacities in many recreation areas, including the National Parks.

Meanwhile, in the course of trying to turn carrying capacity into "the" magic management tool, considerable progress has been made toward understanding why this attempt has failed. Research found that the level of resource deterioration is influenced by other factors such as type, location, and season of use, as

well as amount of use; similarly, research has demonstrated only a weak relationship between visitor satisfaction and number of visitors. Limiting just the amount of use therefore is not the key to managing recreation. It can be helpful and, indeed, is necessary in places where use is extremely high, but it is only one of many management options available.

Over the years, the concept of recreational carrying capacity has been expanded to mean essentially "appropriate management." The original hope was to maintain quality resources and experiences through setting use limits. Attention now has shifted from fixed resource capabilities and amount of use to the desired resource and social conditions.

As modified, the carrying capacity concept now addresses how do manage use (amount, type, timing, location, etc.) to control biophysical and social impacts. The keys to doing this are setting objectives, monitoring conditions, and then gearing management to meet the objectives.

Managers have long recognized and accepted the inevitability of some deterioration in resources and recreational experiences, particularly in areas receiving heavy recreational use. But what constitutes excessive or "unacceptable" change and how do managers define these limits?

Recently, a group of researchers, working with the Forest Service's Wilderness Management Research Unit, put together a framework for management planning called "limits of acceptable change" (LAC) (Fig. 1, next page) that should do what carrying capacity was supposed to do. As so much of the "carrying

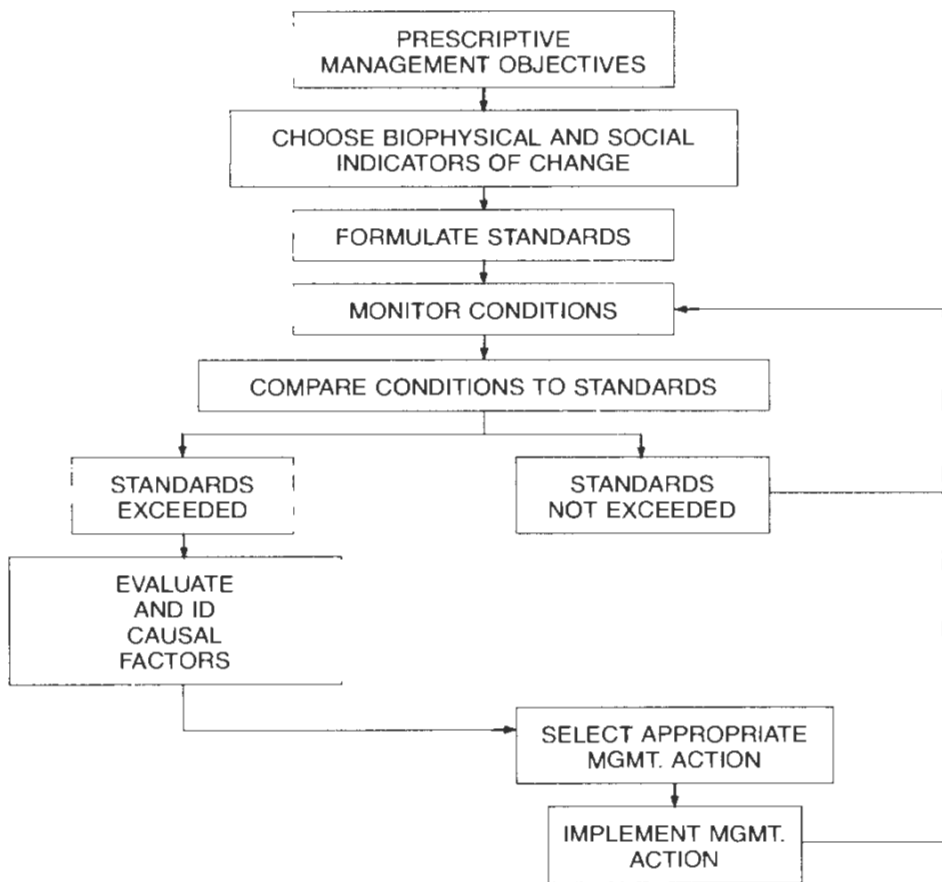


Figure 1. The simplified version of the limits of acceptable change (LAC) planning process.

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capacity" literature stresses, everything flows from management objectives. These define the physical, biological, and social conditions within an area that management seeks to create, restore, or maintain. These objectives are made specific and subject to evaluation by developing quantitative standards for "indicators" of social and environmental conditions. Examples of standards might be "visitors will not encounter more than 10 other parties per day" or "bare ground will not exceed 500 ft² on any campsite."

Standards are established in several steps. First, indicators are selected – for example, number of encounters per day as an indicator of crowding. Current conditions for each indicator are then inventoried as the basis for the formulating individual indicator standards. Indicator standards specify the "limits of acceptable change," establishing a measurable reference point to which future conditions can be compared. These limits define the critical boundary line between acceptable and unacceptable conditions; they should set challenging yet realistic goals for managers. It is important to note that standards represent the *upper* limits of acceptable change. Conditions must not be permitted to deteriorate to this *highest* acceptable common denominator.

Implementation proceeds with the development of a standardized monitoring program, the purpose of which is to assess current conditions with respect to each indicator. Periodic monitoring data are compared with standards. If standards are not exceeded, then monitoring continues, perhaps with an evaluation to determine what changes are occurring and what

preventive actions are appropriate. If standards are exceeded, more drastic measures are necessary. The cause of the problem must be identified and corrective actions taken. If the cause is too much use, then use must be reduced. Often the cause relates to use distribution or behavior; these require different actions. Where use limitation is necessary, deciding on appropriate limits is relatively easy because the critical factors already have been identified. For example, if the problem is four encounters per day in one lake basin, as opposed to a standard of three per day, it would make sense to reduce use in that area by one-fourth.

Once actions are selected, they must be implemented. The rest of the process is repetitive monitoring, a return to an earlier step in the process. **A detailed description of this framework recently appeared in USDA Forest Service Research Paper INT-176, available from the Intermountain Forest and Range Experiment Station, 507 25th Street, Ogden, UT 84401. The report is entitled "The limits of acceptable change (LAC) system for wilderness planning" and was written by George Stankey, David Cole, Bob Lucas, Margaret Petersen, and Sid Frissell.**

Currently this process is being applied in a number of places. Implementation is most advanced in the Bob Marshall Wilderness Complex, three contiguous Forest Service Wildernesses in Montana. A final draft for public review has been completed. David Cole, one of the LAC process developers, has been heavily involved in the Bob Marshall process and has completed a research project on backcountry campsites

at Grand Canyon NP. Grand Canyon recently implemented a backcountry management plan, subject to yearly review. An LAC process may be used to incorporate data from this campsite study and a survey of park visitors into a revised plan.

Managers of the nation's most heavily used wilderness, the Boundary Waters Canoe Area (BWCA) in northeastern Minnesota, also are implementing the LAC planning system. To date, work has focused primarily on resource impacts on the area's 2000 designated campsites. Using campsite impact research by Jeff Marion, managers have selected a number of biophysical indicators, set preliminary standards, and developed a monitoring program. Managers also have identified water quality indicators and are beginning to assess air quality and social indicators.

Although developed for wilderness management, this process is equally suited to management of non-wilderness situations. Recently the Mid-Atlantic Region of NPS entered into a multi-year cooperative agreement with the USDA Forest Service's North Central Forest Experiment Station River Recreation Management Research Unit to investigate appropriate river recreation use in three park units. The LAC planning process has been identified as a potential vehicle for implementing research findings.

Research is underway at the Delaware Water Gap National Recreation Area and the New River Gorge National River to develop standardized impact assessment/monitoring systems for campsites. These management-oriented systems provide site-specific information on the nature and severity of resource impacts that can aid in the formulation of indicator standards. When periodically reapplied as part of an

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impact-monitoring program, these systems allow managers to detect and evaluate deteriorating conditions and to judge the effectiveness of resource protection measures.

At New River Gorge, NPS Resource Management Specialist David Reynolds is planning to integrate the LAC process with the development of a River Management Plan for the area. The River Management Plan will focus on: 1) identifying the most appropriate river recreation experiences; 2) promoting opportunities for the public to have those experiences; and 3) minimizing adverse impacts on the natural, cultural and scenic qualities of the river environment. Following identification of the river management objectives, the LAC process will be used to formulate environmental and social standards not to be exceeded for the river environment and a method to monitor those conditions with a limited workforce.

Meetings are being scheduled to fully involve the public in the river management planning process at New River Gorge. Public involvement helps establish a consensus as to what is and is not a problem. An objective of those meetings is for the different river groups to provide input on the selection of the biophysical and social indicators of change and the formulation of standards. Public involvement in the LAC process also should facilitate the acceptance of any management actions that may be implemented to prevent the chosen standards from being exceeded.

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