

Wilderness Research in Yosemite

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When Yosemite NP was established, few people visited it. Fewer still ventured into the trackless backcountry. Since that time use has increased dramatically and by 1972, it was not unusual to find 200 people camping around one of Yosemite's high country lakes. Such high levels of use caused resource damage and degraded the wilderness experience.

Recognizing the problem, the Park staff initiated a research and management program to provide a system for keeping use within acceptable limits. The program consisted of four steps. The first step was to get a handle on current conditions. What is current use? What problems result from it? Next it was necessary to determine what the optimum level of use should be, based on managerial as well as ecological and sociological constraints. How many should use it? The third step was to develop, test, and select a management strategy that would achieve the acceptable level of use. How do we go about it? Finally, the management strategy was implemented and monitored to see whether or not the objectives had been met. How will we do?

Determining Current Use

Wilderness permits provided the data base for determining use levels. Since permits were first issued in Yosemite in 1972, several years of data were available for establishing trends and patterns (Van Wagtenonk 1980). Actual counts by back country personnel provided good information for specific areas on a limited number of days. This information was essential for verifying permit data. In addition, exit interviews were used to determine travel behavior for backcountry users who did not get permits and to determine the validity of the data for users who had permits (Van Wagtenonk and Benedict 1980a). Questionnaires were used to develop visitor profiles of summer and winter backcountry users (Lee 1975, Gilbert 1980). From these data sources, visitor characteristics and temporal and spatial peaking problems were identified.

Determining Optimum Use

The determination of optimum use, also called carrying capacity, is often the hardest nut to crack. It is defined as the character of use that can be supported over a specified time by an area developed at a certain level without causing excessive damage to either the environment or the experience of the visitor. Since any use causes some damage, the problem becomes one of defining excessive use. What is acceptable change to either the resource or the experience is a management decision.

A conceptual model for making carrying capacity determinations was developed by Van Wagtenonk (1979a). Figure 1 depicts a simplified version of the model, which is currently being computerized. The model shows that as the number of users goes up, resource condition and satisfaction go down. By monitoring the number of users, user satisfaction, and resource conditioning, and comparing them to acceptable levels, management can decide to expend efforts to directly control the number of users, increase satisfaction through education and information, or mitigate resource impacts.

Many of the relationships between users, satisfaction and resource condition were studied in the park in

order to quantify the model. Lee (1975, 1977) and Absher and Lee (1978) gathered data on the effects on visitor satisfaction levels of the numbers of users and resource condition. Foin (1977) and Foin *et al* (1977) studied visitor impacts on numerous ecological variables while Lemons (1979, 1980) focused his attention on meadow impacts. Other vegetation studies included cultural influences (Holmes 1979a, 1979b) and trampling and urine (Holmes and Dobson 1976, Holmes 1979b).

The effect of human use on microclimates was studied by Hecht (1976), on subalpine soils by Malin and Parker (1976), and on bacteria in subalpine and alpine waters by Holmes (1976). Palmer (1979) experimented with various methods to revegetate impacted trails. Studies concerning impacts on animal populations were fewer in number. Keay and Van Wagtenonk (1981) related visitor use levels with incidents with black bears, and Weston and Weston (1979) studied the role of vertebrates in reducing backcountry garbage.

Once the various relationships were graphed, a point on each curve was identified which signified the limit to acceptable change. Again, this was a management decision based on the consequences of that decision. For instance, in figure 2, which relates use to bear incidents, it could be decided that 20 incidents per year in a zone was the maximum number acceptable. That decision might be based on public safety concerns, impacts on the bear population at higher incident levels, or (we hope not) the number of complaint letters which would be received if more incidents occurred. In any event, based on bear incidents alone, a capacity of 60 people per night would be acceptable. The use of such deliberations for all data sets permitted the settling of a maximum use limit for each zone in the backcountry.



Figure 1. Simplified Carrying Capacity Model.

Developing and Testing Management Strategies

If current use levels are greater than optimum levels, a decision must be made to solve the conflict. Numerous indirect methods for rationing use are available but eventually there comes a time when use limits must be imposed. The manager must then have a means to distribute use in accordance with the desired capacities. Several methods are available, from designating fixed itineraries and campsites to allowing a set number of parties to enter each day.

The effectiveness of each method should be tested. This testing could be done by implementing a different

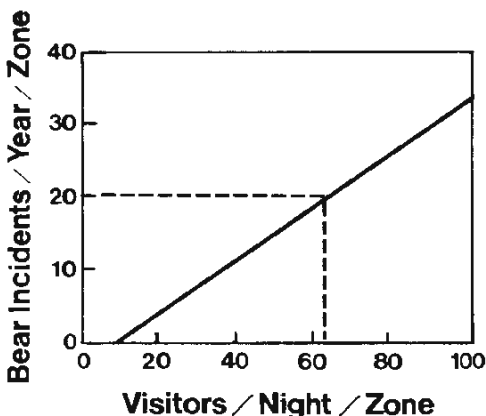


Figure 2. *Relationship of Bear Incidents to Visitor Use.*

method each year and comparing the results. This approach, of course, would take too much time and the results, such as long-lasting resource damage might not be desirable. As an alternative, computer simulation of backcountry use could be conducted with considerable time savings (Van Wagtendonk 1979b).

A simulation model developed for the Forest Service was applied to the Yosemite data to estimate use patterns in the future under alternative management strategies. Input to the model included trail network descriptions, user characteristics, and user-trail interactions. Maps, wilderness permits, and special studies were used to derive the input data (Van Wagtendonk 1978, Van Wagtendonk and Benedict 1980b).

Output from the simulator listed visitor use and encounter levels for each trail segment and camp area by day of the simulation. By changing the input variables the effect of varying trailhead entry volumes was tested to determine a distribution of use which would not exceed the capacities set for the internal zones. These were then translated into trailhead quotas through another computer program.

Implementing and Monitoring The System

The trailhead quota figures derived from the research program were presented to the backcountry management team. This group made adjustments to the quotas based on experience, judgment, and other management considerations. Following these adjustments, trailhead quotas were instituted in the Yosemite backcountry in 1976. Now that the system has been implemented, visitors no longer are required to tell the park where they are going to hike and camp, nor how long they plan to stay.

Another part of the program that has been implemented is increased visitor information. One of Lee's (1975) major conclusions was that visitor expectations played an important role in satisfaction. For instance, on a trail with many users, a person expected to encounter a lot of people probably would not be as disappointed as one who expected to see no one. To insure accurate expectations, maps are available at permit issuing points to show visitors where they might expect high use levels, stock on the trail, and incidents with black bears. With these expectations, visitors can plan their trips accordingly. Additional information also is available on trail distances and travel times (Benedict 1980), and on planning trips using various guide books.

The program has been monitored continually since its inception. Each year the quotas are adjusted in response to the past year's experience. The effect of quotas on overall use trends also has been critically reviewed (Van Wagtendonk 1981). In addition, the park has recognized that the effect of backcountry use on the wilderness resource must be monitored and has proposed several methods of accomplishing that end (Holmes 1981).

Successful implementation of the backcountry man-

agement system was dependent on sound scientific research in cooperation with park operational personnel. The major beneficiary of the system is the backcountry user who now has the maximum freedom possible consistent with management's responsibilities to resources and experiences.

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An extensive Literature Cited for this paper is available from the author, a research scientist at Yosemite NP.