

Visual Air Quality and the National Park Visitor

By David M. Ross and William C. Malm

By mentioning the importance of sweeping vistas, enabling legislation for National Parks often alludes to the importance of good visual air quality as a part of each park's uniqueness and natural beauty. The Clean Air Act (CAA) and its amendments in 1977 reinforced the importance of air quality related values (including visibility) and declared it a national goal for so-called "Class I areas" to prevent any future, and to remedy any existing, visibility impairment caused by man-made air pollution. The CAA made Federal Land Managers of Class I areas responsible for protecting such values and ensuring that no major new facility will have an adverse impact. When determining whether a change in existing air quality will have an adverse impact, the NPS traditionally has considered whether the change will: 1) impair the quality of the visitor experience; 2) impair the structure and functioning of the ecosystem; and/or 3) diminish the national significance of the area.

These decision criteria are broad and leave unanswered many important questions. For example, how can the quality of the visitor experience be assessed? How important is good visual air quality to park visitors? What effect, if any, does a reduction in visual air quality have on visitor enjoyment and/or satisfaction? Does the importance of good visual air quality vary from park to park, from region to region?

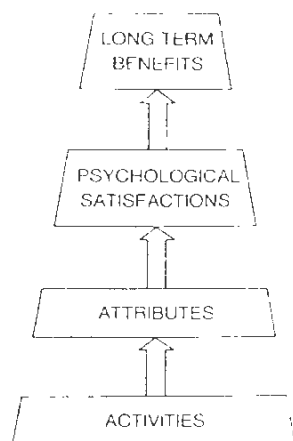
Historically, the bulk of information gathered about park visitors consisted of keeping records on the number of people who came to a park, stopped at the visitor center, stayed at the campgrounds, etc. However, tracking numbers did not reveal why people were coming to the areas and what type of recreational experience they were seeking. Recently, recreation demand theory has evolved to allow for management of recreation as an experience, and some managers are beginning to use the theory to focus on the experiential aspect of recreation.

Recreation demand theory is hierarchical in nature and is based on the premise that visitors will seek out

11. Below are Park features that were listed in Question #9 which can affect your recreation experience. Now for each feature listed below, circle the number which indicates how important each feature was to your recreation experience.

Park Features	Not at All Important	Slightly Important	Moderately Important	Very Important	Extremely Important
1. Information about the park	0	+1	+2	+3	+4
2. Interpretive signs	0	+1	+2	+3	+4
3. Park visitor facilities	0	+1	+2	+3	+4
4. Hiking trails	0	+1	+2	+3	+4
5. Park naturalists/rangers	0	+1	+2	+3	+4
6. Naturalists' program	0	+1	+2	+3	+4
7. Cleanliness of park	0	+1	+2	+3	+4
8. Bus shuttle system	0	+1	+2	+3	+4
9. Views of the river	0	+1	+2	+3	+4
10. Viewing distant rock formations outside the park	0	+1	+2	+3	+4
11. Haze within canyon	0	+1	+2	+3	+4
12. Haze on the horizon	0	+1	+2	+3	+4
13. Viewing canyon rims	0	+1	+2	+3	+4
14. Sunrises or sunsets	0	+1	+2	+3	+4
15. Clouds within canyon	0	+1	+2	+3	+4
16. Cloud-covered sky	0	+1	+2	+3	+4
17. Colorful rock formations	0	+1	+2	+3	+4
18. Deep gorges	0	+1	+2	+3	+4
19. Unusually shaped rocks	0	+1	+2	+3	+4
20. Backcountry permit system	0	+1	+2	+3	+4
21. Campground reservation system	0	+1	+2	+3	+4
22. Clean, clear air	0	+1	+2	+3	+4
23. Variety of flowers, shrubs, and trees	0	+1	+2	+3	+4
24. Variety of birds & animals	0	+1	+2	+3	+4

Figure 2. Attributes and response format used to determine visitor ranking of importance for various park attributes.



RECREATION DEMAND HIERARCHY

Figure 1. Recreation demand hierarchy

a recreational experience that will maximize their physical and psychological well-being. Figure 1 shows a four level version of the recreation demand hierarchy. Level 1 is the demand to participate in a specific activity. Level 2 involves participation in a setting that offers the social, resource and managerial attributes desired. Level 3 is the psychological satisfactions (such as learning more about nature) obtainable from activities that require interaction with selected park attributes. Level 4 is the demand for various long-term benefits such as better job performance or increased family togetherness. The realization of level 4, long-term, benefits is dependent on how well the visitor's desires for the first three levels

have been met.

A simple example is that of a person who travels to the Grand Canyon to participate in hiking and viewing canyon rims (demand level 1). While engaging in these activities the individual might prefer that the air be clean and free of pollution and the trails not be crowded (demand level 2). By engaging in the desired activities in a recreational setting that contains the attributes deemed important, the individual experiences psychological satisfactions such as experiencing nature and solitude (demand level 3). A long-term benefit that might come from participating in the desired activities with the desired attributes present and with the desired psychological satisfac-

tions realized could be enhanced work performance (demand level 4).

The key to effective management in terms of the recreational experience is to manage for the first and second levels of the hierarchy. For example, certain activities can be allowed only in specified areas of the park or must be prohibited throughout the park. (Level 1) It is also possible, although more difficult, to manage park attributes (such as good visual air quality), that are important to park visitors. (Level 2) Managing for the third and fourth levels of the hierarchy is more difficult because these levels are abstract. However, levels 3 and 4 can be provided for indirectly through appropriate management of demand levels 1 and 2. If the activities desired and the attributes deemed important are present at the park area, and if visitors are highly satisfied with the quality of each, the third and fourth levels of demand are more likely to be realized than in a case where desired aspects of levels 1 or 2 are not present or are perceived to be of poor quality.

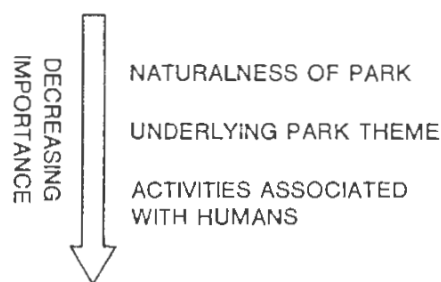


Figure 3. "Clustering" of preferred attributes shown here in order of visitor preference.

Four National Parks Surveyed

A basic step, then, in maximizing the recreation experience is to understand which park attributes the visitor feels are most essential to a positive experience. To examine the importance of park attributes to the visitor experience (demand level 2), mail-back surveys were used to collect data at Grand Canyon, Mesa Verde, Mount Rainier and Great Smoky Mountains NPs during the summers of 1983 and 1984. Figure 2 shows the attributes and response format used at Grand Canyon. While the list of attributes varied among parks, the response format used was the same at all parks.

Cluster analysis was used to determine if clusters, or groups of park attributes, could be identified based on visitors' responses to the importance of attributes. This analysis was performed not only to reduce the large number of variables involved, but also to determine which park attributes belong to certain "domains" of attributes in the visitors' minds. For example, it might be expected that attributes about park management could be clustered into one group, while attributes about the park's natural resources would cluster into another group. Results showed five clusters of attributes at Grand Canyon and Mesa Verde, and three and seven clusters of attributes at Mount Rainier and Great Smoky Mountains respectively.

The analysis yielded a number of trends. First, a cluster of attributes was identified at all parks that could be associated with natural environments undisturbed by humans. Attributes included in this cluster were "Clean, clear air," "Clean, clear water" and "Cleanliness of the park." For lack of a better term,

this set of attributes will be referred to as the "naturalness cluster." This cluster ranked as most important at all four parks.

Secondly, the cluster analysis suggests that the second most important set of attributes is associated with the underlying theme for which the park is famous; the least important clusters consisted of attributes associated with human activities (see Fig. 3). For example, while naturalness was the most important cluster of attributes at both Grand Canyon and Mesa Verde, a view related cluster at Grand Canyon and an information related cluster (which emphasized park history) at Mesa Verde ranked as the second most important cluster of attributes at those parks, respectively. In the least important clusters were attributes such as "backcountry reservation system," "guided tours," and "shuttle bus systems." As a general hypothesis, it is suggested that visitors to national parks feel that a natural environment, free of pollution and undisturbed by humans is most important to their experience, and the underlying theme of the park is second most important.

Data also were collected at Grand Canyon and Mesa Verde, using on-site interviews, to examine what effect visual air quality might have on the recreational experience sought. Visitors were asked to judge their awareness of haze and the effect haze might have on their enjoyment of the visual resource. They also were asked to indicate whether they thought the haze was man-made or natural.

Results of this portion of the study showed that at Grand Canyon 76 percent of the visitors interviewed indicated they saw haze and at Mesa Verde 86 percent of the visitors interviewed thought they saw haze. Comparisons of visitor awareness of haze at the Grand Canyon and a physical measure of the actual visibility at the time of the interview showed

that changes in visitor awareness of haze corresponded to changes in visual air quality (see Fig. 4). As visitors said they became more aware of haze, their reported enjoyment of the view and their satisfaction with visual air quality decreased. Of the visitors who said at the interview they saw haze, 80 percent and 83 percent at the Grand Canyon and Mesa Verde, respectively, felt the haze was natural. The results of these studies have several implications for park management.

If the park areas are to be managed in a way that will allow visitors to maximize their sense of well-being, these findings suggest that special attention should be paid to preserving the resources that make up the naturalness cluster. Visitors are primarily seeking a recreational experience in an environment that is natural, free of pollution, and undisturbed by humans.

It also is important to emphasize that the visitors' perceptions of how much haze is natural or man-made is in direct contradiction to actual measurements at these parks. While 80 percent or more of visitors think the haze is natural, monitoring programs show that 60 percent to 80 percent of the haze is associated with urban and industrial sources. Since the majority of visitors feel that haze in national parks is natural, when in reality it is mostly man-made, we suggest that interpretation and education programs proceed to inform the public of the reality and of possible resource consequences that could occur with the transport of pollutants into national parks.

Ross is a Research Social Scientist with Air Resource Specialists, Inc., Fort Collins, CO; Malm is Research Physicist with the NPS Air Quality Division in Fort Collins.

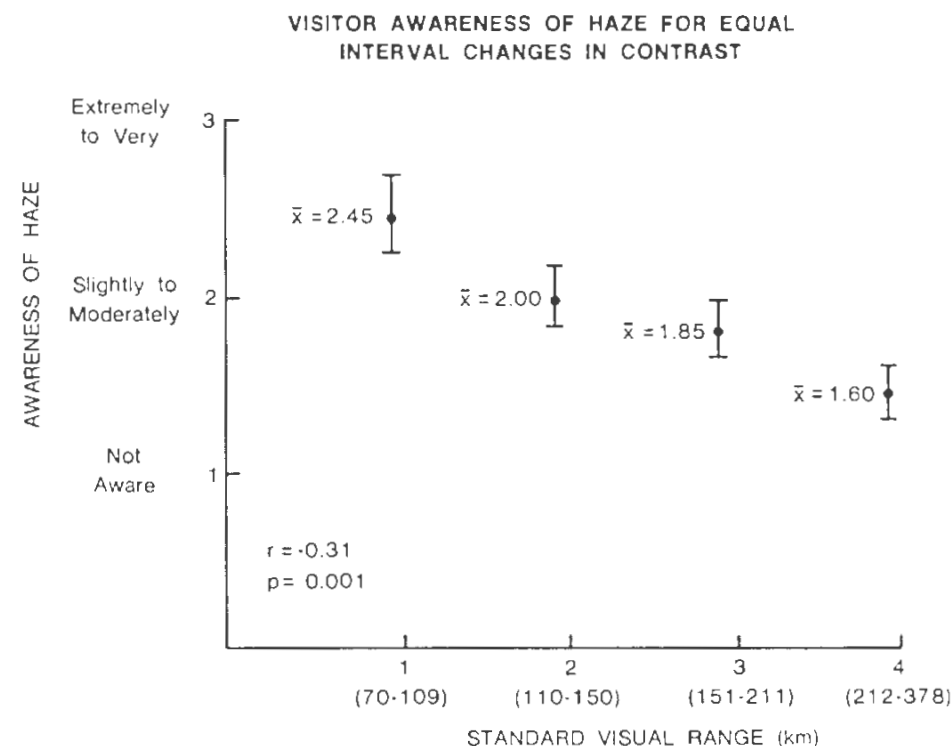


Figure 4.