

# Projecting the Visual Carrying Capacity of Recreation Areas<sup>1</sup>

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**Abstract:** The aesthetic experience of people utilizing the recreational resources of the national parks and forests of the United States is of primary importance since a large percentage of perception is visual. Undesirable intrusions into this sphere of perception substantially reduce the level of enjoyment or satisfaction derived from the recreation experience. Perceived visual disturbance levels of visitors to recreation areas were elicited on the following issues: 1) levels of perceived crowdedness, and 2) the presence of man-made elements in the use area, 3) the influence of man's actions on the landscape, and 4) the incidence of man-made elements in the viewing area. Disturbance level scores of hikers, picnickers and landscape architecture students indicate that visual disturbance levels increase as the incidence of disturbance elements increase. It is apparent that different users of recreation areas or use with a different intent will affect the visual carrying capacity of an area,

## INTRODUCTION

Increasing demand for the utilization of recreational resources in the national parks and forests of the United States is a major concern of resource managers. Since the ORRRC reports (1962) overuse has reached such a level that recreation area use, Yellowstone National Park for example has been limited at peak times in the interest of ecology and the quality of the recreational experience of the users. Lovejoy (1973) states that: "The degree to which forests can absorb crowds without detriment is becoming an ever-more important factor in this overcrowded world. It must, however, be realized that forests have a saturation point, beyond which the

health, as well as the enjoyability of the woods will decline." This saturation point is most often referred to as carrying capacity, and has long been utilized to determine the resource potential of forest and range lands for purposes of management.

Recreation carrying capacity research has generally focused on physical site factors (Wager 1974) rather than on visual or perceptual conditions. The fundamental significance of this issue is that a large percentage of an individual's perception is visual. Since this involves the aesthetic experience in a particular resource based recreation area, the manner in which a visitor perceives a site will be an important factor in his level of enjoyment or satisfaction. This study focuses on whether various levels of intrusion adversely affect a visitor's visual experience; and, if so, attempt to determine which elements appear to be most visually disturbing.

It is essential to recognize, however, that carrying capacity is not a single absolute value, but a multi-dimensional concept. Although the

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term is frequently used, it is seldom understood, Stankey and Lime (1971) contend that no fixed figure can be singled out for a recreation area and be designated as the carrying capacity, Factors such as management objectives, physical resources, visual impact, type of user and volumes of use must all be considered in determining the optimum carrying capacity for a recreation area, In this study, carrying capacity is generally defined as "the amount of recreation use of a recreation resource which reflects the level of use most appropriate for both the protection of the resource and the satisfaction of the participant" (BOR 1977). Essentially, it is the level at which the visitor's experiential quality is maximized, while complying with the above restraints.

Visual carrying capacity does not fit easily into the resource manager's perception of carrying capacity in that the effects are not easily quantified. Physical carrying capacity, which has been the focus of much research, deals with the actual physical determination of a site. Visual carrying capacity, however, embodies cultural values and relies heavily on how a visitor perceives a particular site for its determination, There is evidence to support the notion that increases in deterioration of recreational resources have caused many frustrations for visitors seeking an enjoyable experience (BOR 1977). In addition, there appears to be a paucity of information specifically correlating carrying capacity to visual quality.

Visual carrying capacity refers to conditions which an individual finds pleasing to the senses. On a particular site, it can be related to the perception of visual quality as it is affected by natural features, modifications of those features or deterioration of the environment (Bury 1976). Further, a visitor tends to express his satisfaction in terms of on-site perception, instead of expectations before the site is visited. For example, if a site is heavily used, it will inevitably produce signs of deterioration of the visual quality of the site. This, in turn, may adversely influence the quality of the visitor's experience particularly if he enjoys relatively undisturbed areas. Thus, the capacity of the site to instill a high quality of experience for its users will decline concurrently with the decline of the optimum carrying capacity level.

#### THE STUDY

A study to elicit perceived visual disturbance levels of visitors to recreation areas

was designed which includes a consideration of the following issues: 1) levels of perceived crowdedness, 2) the presence of man-made elements in the immediate vicinity of the recreation experience, 3) the influence of man's action on the landscape and 4) the incidence of man-made elements in the viewing area.

1) Levels of perceived crowdedness is based on the hypothesis that individuals prefer less crowded areas for recreation enjoyment (Carls 1972). It is important to note that numbers of people alone do not cause crowdedness. Rather, crowding is essentially a subjective, individual perception of density, The context of the situation defines the appropriateness of the actual density (Stankey et al., 1976). However, "crowding does not detract from aesthetic enjoyment unless it destroys either the object viewed or the atmosphere in which it is viewed" (Willard 1971).

2) The presence of man-made elements in the immediate vicinity of the recreation experience is an issue which hypothesizes that individuals will prefer to use areas that are more natural than man influenced. Carls (1972), in a study of preferences for outdoor landscapes, found that "landscape scenes exhibiting a high magnitude of man-induced objects or conditions are less preferred than scenes with lower magnitudes--high levels of development detract from the aesthetic view of a landscape."

3) One issue is the influence of man's action in the landscape and this generates the hypothesis that people generally prefer to use trails or other recreation areas that are less physically disturbed or deteriorated. Bury (1976) contends that a relatively high level of use produces "signs of wear and tear on the natural beauty of a site," and that "this deterioration relates directly to the site's capacity to produce high quality experience for visitors who value natural, undisturbed areas."

4) Another issue is the incidence of man-made elements in the viewing area (from an overlook for example) which generates the hypothesis that man-made elements detract from the visitor's aesthetic enjoyment of that landscape. Zube et al. (1974) found that natural features "have a positive effect on scenic resource values" and that the intrusion of man-made elements leads to a great deal of variance among evaluators. Within recent years there has been general agreement that higher levels of development in a landscape setting leads to a reduction in preference (Carls 1972).

## TESTING PROCEDURE

The above mentioned issues were represented by 12, 3-inch x 5-inch color photographs of recreation scenes in the Rock Bridge Recreation Area of the Daniel Boone National Forest, Kentucky. The photographs were selected according to three levels (high, moderate, low) of: 1) crowdedness, 2) presence of man-made elements in the use area, 3) man's actions in the landscape and 4) interference of man-made elements in the viewing area. All of the photographs represented outdoor recreation scenes or activities ranging from people using picnic areas...to hikers using trails...to views from an overlook area. To avoid seasonal bias, all photographs were taken in early September before leaves began to change color.

Color photographs were chosen as a means of assessment primarily for their availability and convenience to the on-site testing procedure. There are three basic advantages to using color photographs as a means of testing: the standardization of scenes (a ready frame of reference), no transportation of respondents (applicable only to landscape architecture student respondents) and as a measurement of landscape variables (Carls 1972). There is some question whether simulations, as a surrogate for on-site experiences, are an appropriate testing mechanism due to the relation of the other senses on the psychological perspective of the respondent toward these stimuli and the activity itself. However, Shafer and Richards (1971) and Zube *et al.* (1975) have demonstrated that color photographs are an efficacious means of eliciting evaluative responses. Kaplan and Wendt (1972) point out that "people like nature, that they even have a preference for graphics and photographic representations of nature ... understanding this preference may be an important step in the large and vital task of understanding the kinds of environments necessary for man's psychological well-being."

Three groups of respondents (N=177) were shown 12 photographs and asked to evaluate each in terms of the perceived visual disturbance felt when viewing the photo (1= not disturbed to 5= greatly disturbed). Two of the groups, 1) hikers (N=93) -- those visiting the park primarily to utilize the trails, and 2) picnickers (N=56) -- those visiting the park primarily to utilize the picnic facilities, were interviewed at the Rock Bridge Recreation area. The third group (N=28) consisting of junior and senior landscape architecture students at the University of Kentucky were interviewed during a class period.

Hikers, as a group, were selected on the premise that they hike individually or in small groups of 2 or 3 and would be less tolerant of disturbances that deviate from the natural landscape or of large numbers of people. Picnickers, the second group, were selected on the premise that they would be more people-oriented and more tolerant of man-induced influences on the natural landscape. Their activities would appear to indicate this in that picnic areas are generally utilized by fairly large numbers simultaneously and certainly suffer from more physical degradation than do hiking trails. The landscape architecture students were selected to determine whether individuals in an environmental design profession would be more tolerant or less tolerant of man-influenced disturbances and large numbers of people than the other two groups especially since the landscape architecture students have been trained to recognize and understand visual quality.

On two successive weekends in October, 1978, 149 people were interviewed in the Rock Bridge Recreation area. They were shown the series of 12 photographs, using six randomly ordered sets to minimize photo-order bias, and asked to rate each on the previously discussed level of felt-disturbance. Respondents were not requested to rank order the photos nor was there an attempt to get a comprehensive score across the entire photo grouping. The issue was to determine whether the respondents would express a feeling of disturbance relative to the depictions in the photographs.

## RESULTS

### Levels of Crowdedness

The hypothesis that individuals prefer less crowded areas for their recreational experiences and, as a result, will be more disturbed by photos which evidence a larger number of people in them was substantiated by the photo grouping in table 1. The level of disturbance increased distinctly from the A3 photo to the A1 photo and the levels of non-disturbance increased in the opposite direction. When viewing the sample in their respective groups (hikers, picnickers, landscape architecture students) some significant<sup>3/</sup> differences appear. Hikers were very disturbed

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<sup>3/</sup> chi-square statistic was utilized to test for differences. A probability level of .10 or greater was accepted as significant.

by a large number of people in the scene but were not greatly disturbed by the medium and low levels. Also, they were generally more disturbed by all levels of crowdedness than either the picnickers or the landscape architecture students. The picnickers, on the other hand, were generally less disturbed by all levels of crowdedness. This is especially true with respect to the A1 photo where many were not disturbed by the highest level of crowdedness shown. The landscape architecture students were neither greatly disturbed nor undisturbed by the number of people in the photos. Rather, they were mildly disturbed by all the photo situations.

Table 1--Level of crowdedness

|                                     | Photo A1*<br>High(a) |        |      | Photo A2*<br>Moderate(b) |        |      | Photo A3*<br>Low(c) |        |      |
|-------------------------------------|----------------------|--------|------|--------------------------|--------|------|---------------------|--------|------|
|                                     | Very                 | Mildly | None | Very                     | Mildly | None | Very                | Mildly | None |
| Hikers<br>N=93                      | 40                   | 38     | 23   | 14                       | 41     | 45   | 4                   | 24     | 72   |
| Picnickers<br>N=56                  | 23                   | 36     | 41   | 20                       | 38     | 43   | 0                   | 27     | 73   |
| Landscape Arch.<br>Students<br>N=28 | 21                   | 43     | 36   | 11                       | 68     | 21   | 0                   | 50     | 50   |
| Total<br>N=177                      | 32                   | 38     | 31   | 15                       | 44     | 41   | 2                   | 29     | 69   |

\*Figures represent percentage of disturbance

(a)  $\chi^2 = 8.596$  with 4°F, significant at 0.072

(b)  $\chi^2 = 8.62$  with 4°F, significant at 0.0713

(c) Statistics not valid because of "0" cells

The issue of carrying capacity, relative to the perception of crowdedness in the photos, reveals that individuals are not disturbed by low numbers of people in outdoor recreational areas. As numbers increase the level of disturbance increases to where disturbance (mild or high) is expressed by a majority of the respondents. Individuals are disturbed by what they perceive as crowded conditions in outdoor recreation areas. This negatively affects their enjoyment level and, thus, the perceptual or visual carrying capacity of the recreation area is decreased or surpassed.

While the reaction of the on-site users was anticipated, it is interesting to note the landscape architecture students' generally mild concern for crowded conditions and their perception of people as being an undisturbing factor in the pursuit of visual quality. This can possibly be explained by their training as designers of spaces for human use and enjoyment. In this respect they would be gratified to view a recreation area that is neither over crowded nor under utilized. People using the facility would not be a cause for great disturbance. There may be concern that too large a crowd would detract from the visual amenities of the area and thus the recreational enjoyment.

#### Presence of Man-Made Elements

In this series of photos (table 2) it was hypothesized that the disturbance level of individuals will increase as the presence of man-made elements increases in the outdoor recreation landscape; an issue which was corroborated by the photo test across the entire sample. As the incidence of man-made elements in the landscape increased the percentage of very disturbed responses increased and vice versa for the non-disturbed responses. Among the groups, the landscape architecture students appear to be the most sensitive to the presence of man-made elements in the outdoor recreational scene. Many were very disturbed by the B1 photo with just a few expressing a feeling of non-disturbance. In comparison, hikers expressed disturbance at the higher level presence of manmade elements but were not particularly concerned over the low level. As in the crowdedness photos the picnickers were somewhat less disturbed by the presence of man-made elements in the recreation area than their fellow recreation users, the hikers.

The landscape architecture students' extremely sensitive concern for the presence of man-made elements in the scene may be attributed to several factors. Unlike the hikers and picnickers they were not utilizing the picnic facilities or the hiking trails at the time of the testing but were interviewed in a design class situation. Another issue is that they, as designers, may have been disturbed by what one individual called "the clutter" of the scenes. In other words, their perception of well designed recreation areas may not have concurred with what they saw in the photographs, thus they were critical. The indication of less disturbance on the part of the picnickers may be rationalized on the basis that they were actually in the process of using similar facilities.

They were relating more closely to the scenes and were not as disturbed as the hikers who were just passing through to utilize the adjoining trail system. This is consistent with Brush's (1976) findings that "non-experts" (the general public) have a tendency to be more tolerant of "man-made influences, particularly those that are familiar to them, or that contribute to their own comfort and convenience" and that "the ratings of observers are influenced to some extent by their . . . prior experience."

Table 2--Presence of man-made elements in the use area

|                                        | Photo B1*<br>High(a) |        |      | Photo B2*<br>Moderate(b) |        |      | Photo B3*<br>Low(c) |        |      |
|----------------------------------------|----------------------|--------|------|--------------------------|--------|------|---------------------|--------|------|
|                                        | Very                 | Mildly | None | Very                     | Mildly | None | Very                | Mildly | None |
| Hikers<br>N=93                         | 27                   | 45     | 28   | 16                       | 25     | 59   | 2                   | 16     | 82   |
| Picnickers<br>N=56                     | 23                   | 41     | 35   | 13                       | 35     | 51   | 4                   | 18     | 79   |
| Landscape<br>Arch.<br>Students<br>N=28 | 71                   | 29     | 0    | 14                       | 57     | 29   | 4                   | 36     | 61   |
| Total<br>N=177                         | 33                   | 41     | 26   | 15                       | 33     | 52   | 3                   | 20     | 77   |

\* Figures represent percentage of disturbance  
(a) Statistics not valid because of "0" cell  
(b)  $X^2 = 11.108$  with 4°F, significant at 0.025  
(c) Significant levels less than allowable .10

In respect to the presence of man-made elements having an affect on the visual carrying capacity of a recreation area, the issue does not appear as strong as the crowdedness issue. It was not until the high level of man-made elements photo that a majority indicated some level of disturbance. Evidently some man-made elements in the recreation area are entirely acceptable for all groups--are even expected, e.g., toilets, water, tables, etc. When they reach such a level that the elements begin to appear everywhere, problems develop and visual perceptions are distinctly offended.

#### Presence of Man's Influence

The third photo grouping results, that of the presence of man's influence on the outdoor recreation scene (table 3), concurred with the hypothesis that the level of disturbance would increase as the presence of influence increased. Relative to the previous photo groupings it is interesting to note that the overall level of disturbance was not very great, even for the photo with a high level of man's influence present. Statistically, except for the landscape architecture students in photo C1, there was little group differentiation. The landscape architecture students, as in the case in the previous photo set, were considerably more disturbed by the high level of man's influence than were the on-site users.

The hikers, who in the two previous photo groupings were disturbed by people and man-made elements, were relatively non-disturbed in this case. However, since the hikers came to the recreation area to utilize the trails and the photos depicting degradation of the recreation scene were of such trails, it was not very likely that they would express great disturbance by their condition, no matter how worn or eroded. Wohwill (1976) suggests that familiarity acts to decrease disturbance and that individuals tend to prefer landscapes that are similar to ones which they are most closely affiliated. Thus, familiarity with a specific environment tends to obscure the dissonance of its general arrangement (Nieman 1978).

The landscape architecture students' sensitiveness throughout is not as easily explained on the basis of the data collected and further testing would be required. It must, however, be emphasized that they were not actively engaged in an outdoor recreation pursuit at the time. Without a vested interest to relate to in the sense of enjoyment, they were apparently at liberty to be more discriminating and thus to indicate a higher level of disturbance. The fact that the trails were eroded and obviously overused could also have affected their environmental design sensitivities and influenced them to react negatively to environmental degradation whatever the situation.

The visual carrying capacity issue in this situation is not so clear cut. Even at the highest level of man's influence only 39 percent of the sample expressed any feeling of disturbance. In this case photos of blatant destruction, such as vandalism, were not utilized in an attempt to screen other perceptions

from unduly influencing the judgment. Apparently on-site recreation users are willing to accept a certain degree of site degradation if it has resulted from normal every day use. While park managers may be concerned over site degradation it does not follow that the public will perceive such degradation as unacceptable or undesirable (Hendee and Harris 1970). In addition, Lucas (1970), found that Forest Service Administrators ranked the quality of recreational sites much differently than did the users. They consistently ranked the sites higher and more desirable than the managers, who had ranked the sites only as fair. Consequently, on-site users' expression of a significantly lower level of visual disturbance than the landscape architecture students' is consistent with other findings.

Table 3--Presence of man's influence

|                                        | Photo D1*<br>High(a) |        |      | Photo D2*<br>Moderate(b) |        |      | Photo D3*<br>Low(c) |        |      |
|----------------------------------------|----------------------|--------|------|--------------------------|--------|------|---------------------|--------|------|
|                                        | Very                 | Mildly | None | Very                     | Mildly | None | Very                | Mildly | None |
| Hikers<br>N=93                         | 3                    | 29     | 68   | 2                        | 7      | 91   | 0                   | 4      | 96   |
| Picnickers<br>N=56                     | 5                    | 29     | 66   | 2                        | 14     | 84   | 0                   | 4      | 96   |
| Landscape<br>Arch,<br>Students<br>N=28 | 25                   | 46     | 29   | 7                        | 25     | 68   | 4                   | 14     | 82   |
| Total<br>N=177                         | 7                    | 32     | 61   | 5                        | 12     | 85   | 1                   | 6      | 94   |

\*Figures represent percentage of disturbance  
(a)  $\chi^2 = 22.389$  with 4°F, significant at 0.002  
(b) Significance levels less than allowable .10  
(c) Statistics not valid because of "0" cell

This difference suggests that professionals may not be totally perceptive to the actual feelings of the recreational user. It is also evident that issues beyond the actual physical conditions of the site or the numbers of people using it influence the decision to be less critical of a site's amenities than those reacting in a more objective sense, i.e., managers and designers.

#### Views with the Presence of Man-Made Elements

The results of testing in the fourth category of man-made elements in the view (table 4), concurred with the hypothesis of increasing disturbance as the level of disturbance-elements increases, but only marginally. Very little disturbance was registered by the sample as they viewed the photos. In both the high and the moderate photos, the majority did not see the presence of man-made elements as disturbing. Further, there was little disturbance difference among the three groups. All generally agreed that the presence of these particular man-made elements in the view was not particularly disturbing. As related to visual carrying capacity, two issues can be addressed that may help to explain the lack of expressed disturbance. Grossly obtrusive objects like power lines or stacks belching smoke were not utilized in the photos, rather they were relatively orderly. Rabinowitz and Coughlin (1970) found that people prefer man's influence in the natural landscape as long as it is orderly and does not contain evidence of visual pollution. Secondly, this was the only series of photos which included water in the scene. Brush and Shafer (1975) contend that moderate proportions of water tend to add to an individual's perception of visual quality in the landscape and Kaplan (1977) found that water provides a unifying and continuing theme to the landscape. It appears that the context of man-made elements in the landscape may be an important factor in that if they are perceived as orderly and possibly even belonging, they do not detract from the visual enjoyment of the scene.

Table 4--Views with man-made elements

|                                        | Photo D1*<br>High+ |        |      | Photo D2*<br>Moderate+ |        |      | Photo D3*<br>Low+ |        |      |
|----------------------------------------|--------------------|--------|------|------------------------|--------|------|-------------------|--------|------|
|                                        | Very               | Mildly | None | Very                   | Mildly | None | Very              | Mildly | None |
| Hikers<br>N=93                         | 13                 | 24     | 63   | 9                      | 24     | 68   | 0                 | 7      | 94   |
| Picnickers<br>N=56                     | 7                  | 23     | 70   | 7                      | 21     | 71   | 0                 | 5      | 95   |
| Landscape<br>Arch.<br>Students<br>N=28 | 0                  | 36     | 64   | 7                      | 43     | 50   | 0                 | 7      | 93   |
| Total<br>N=177                         | 9                  | 25     | 66   | 8                      | 26     | 66   | 0                 | 6      | 94   |

\*Figures represent percentage of disturbance  
+No statistically significant differences among the groupings

## CONCLUSION

The results of the study indicate that disturbance levels increase as the incidence of disturbance elements increases. While the trend in this direction is consistent across the entire sample, individual groups varied in the magnitude of felt disturbance. Crowdedness as a visual carrying capacity element was a clear indicator of disturbance, as was the presence of man's influence and views with man-made elements in the scene in that the respondents were not greatly disturbed by their appearance. It is important to reiterate that the scenes were relatively ordinary. They did not include spectacularly beautiful views or exceptionally undesirable situations. Since the majority of recreational experiences, especially in the Kentucky region, are undertaken in ordinary situations it was thought appropriate not to confuse the respondents with extraordinary situations.

Group variance also evolved which verifies the issue of use intent or situation. Hikers are most disturbed by high levels of crowdedness, followed by the presence of man-made elements, views with man-made elements and the presence of man's influence. This concurs with the general intent of hiking, that of using a developed trail system to escape people and their elements and to enjoy the scenic quality of the area. Had the presence of man's influence-elements been other than eroded trails perhaps the disturbance level of hikers would have been higher. This, however, reinforces the issue of intent. The intent was to use the trails, therefore, some degradation of the trail system was not all that disturbing.

Picnickers were also disturbed by high levels of crowdedness and the presence of man-made elements but not to the extent of the hikers. Throughout the evaluation they were more tolerant of disturbance elements. Once again this is consistent with their intent and expectations. They came to the area intending to utilize the recreation facilities and they expected to see recreational situations similar to the ones in the photos. The concept of familiarity appears to be a dominating influence in that these are situations normally experienced by picnickers.

Landscape architecture students, the only group not interviewed while participating in an outdoor recreation experience, were greatly disturbed by the presence of man-made elements in the recreation landscape. Their next highest concern was for the presence of man's influence which is in contrast to the other groups who expressed little concern for trail degradation. Levels of crowdedness were next, followed by views with man-made elements.

The issue of visual disturbances affecting an individual's perception of the visual carrying capacity of an area leaves little doubt that people are disturbed. On-site users, however, tend to be less disturbed and are certainly less critical of interferences in the natural scene. On the other hand, landscape architecture students appear to be more sensitive to visual interferences. Their intent, of course, is different than that of the on-site users. It is likely that their criticism is more technical, as a result of their training, than their feelings as potential site users. This introduces the issue of environmental designers planning recreation areas not knowing what users prefer or what they will accept. Another possibility exists that designers are viewing the scenes with more environmental knowledge and therefore foresee a time, somewhere in the future, when the recreational area will be unsuitable for use from both an ecological and aesthetic perspective.

Clearly, different groups of users or use of recreation areas with different intents affect the visual carrying capacity of an area. While other carrying capacity issues, in the physical sense, continue to be important considerations, knowledge of when the visual sensitivities of recreation users are offended and in what respects will aid greatly in the control and use of existing park facilities and the design of new facilities. Knowing, a priori, where this point is likely to be will benefit park planners and ultimately influence the success of recreational experiences.

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