Measuring Familiarity for Natural Environments Through Visual Images[1]

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Abstract: An on-site visual preference methodology involving a pre-and-post rating of bog landscape photographs is discussed. Photographs were rated for familiarity as well as preference. Preference was-shown to be closely related to familiarity, assuming visitors had the opportunity to view the scenes during the on-site hiking engagement. Scenes rated high on preference were likely to be scenes that visitors rated most familiar. In addition, familiarity ratings indicated that visitors were quite cognizant of what scenes they had or had not seen during the on-site hike. A single on-site experience was enough for visitors to recall what they had seen, with repeat visitors showing no apparent increased familiarity. Thus, considerable information concerning natural environments appears to be processed and recorded by visitors during on-site experiences.

INTRODUCTION

Familiarity is known to be an important component of environmental preference, be it visual or otherwise. Familiarity gained through prior information and past experiences can be vital to how humans will react to an environmental scene. The way people perceive and think, the way they take in and process information from the environment, are a consequence of past experiences (Kaplan and Kaplan 1978). Through past experiences, people develop cognitive models of their environment, which in turn, aid in the perception of future environments.

To date, we know little concerning those properties of natural environments that aid or hinder the construction of cognitive models. What kinds of environmental qualities are important in the development of cognitive representations of environmental events, places and scenes? What about the cognitive processes involved? How instrumental is each environmental encounter, and in particular, preferred environmental encounters, in cognitive model formation? Most resource managers would agree that such information is important if we are to manage for visual and environmental preferences. Mercer (1975) points out the importance of this area of research in outdoor recreation when he suggests that future studies include, "how recreation behavior and environmental preferences are learned and how the mental maps of recreationists develop." This paper attempts to answer a portion of Mercer's question by determining what visitors remember visually from an on-site recreational experience. Certainly, recall or recognition is an initial step in the cognitive model or mental map process.

An information processing and cognitive map approach to how individuals know and relate to their environment is not new. Tolman proposed the cognitive map idea in 1948. But it was Lynch (1960) who really developed the idea when he had individuals sketch "mental maps" of their cities. Lynch found that people have different cognitive models of their cities, depending on individual experiences, and do-

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[1/] Presented at the National Conference on Applied Techniques for Analysis and Management of the Visual Resource, Incline Village, Nevada, April 23-25, 1979.

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minant features of various cities. Downs and Stea (1973), and Moore and Golledge (1976), provide additional articles which develop the cognitive model idea. Many of these references, however, pertain to urban and other man-made physical environments. Kaplan and Kaplan (1978) and their colleagues have investigated various natural environments for preference from an information processing and cognitive model approach. Of particular interest to this paper is a study by R. Kaplan (1976), which involved the use of different materials and experiences to familiarize people with way-finding in natural environments. Both the materials (i.e., maps, photographs) and the experiences (i.e., games, etc.) were evaluated as to their effectiveness in aiding individuals to develop adequate internal models of the environment.

The purpose of this study was to investigate the relationship between visual preference and resulting familiarity for natural environments. The rating of photographs for familiarity following an on-site environmental experience, in order to determine the degree to which visual information enters memory, is an approach new to the literature. Would one expect preferred scenes to be more likely to be remembered, and perhaps be a basis for cognitive models? The familiarity issue, of course, depends ultimately on the adequacy of an individual's internal model of the environment developed as a result of on-site encounters.

CONCEPTUAL BACKGROUND

The conceptual basis underlying the design of the present study and the interpretation of the results is based on a theory that involves how people process environmental information and form cognitive models. Simply stated, the theory proposes that humans, as evolutionarily successful organisms, are efficient at processing environmental information, and that humans are constantly building mental models of the environment they experience. Through environmental encounters, humans are exposed to considerable environmental information, which is processed and incorporated to varying degrees into mental representation of the external environment. The mental models which one develops from environmental encounters are, in turn, instrumental in how one interprets future environmental encounters. As stated by Kaplan and Kaplan (1978):

> the cognitive map (or mental model) provides a link between the human thought process and the physical environment. The way an individual experiences and reacts to a given environment begins to be understandable in the context of an experience-based internal structure that corresponds, at least in certain respects, to the environment in question (p. 43).

Also basic to the conceptual framework of this study is the belief that humans are primarily "visual" processors of environmental information. While the perception of natural environments is a complex process, involving all of our senses--our past experiences and their lasting traces in memory, it is vision that humans depend on most for relating to the environment. Sight is of crucial importance and probably influences human response to environments more directly and with greater salience than do our other senses (Shafer 1969). Even when the other senses are involved in the processing of information, it is seldom that they are not associated with a visual image, either called-up from memory or existing in the physical environment. Preference for certain environments or aspects of environments depends largely on the visual resources perceived in that environment and the associated information processed with that encounter and past encounters. Through repeated experiences, humans group into classes or categories (Bruner. 1957) or schemata (Attneave 1957) those visual images which they encounter most frequently, find intriguing and gravitate toward for various reasons. Thus, recognition of objects and environmental scenes is an important function of cognitive model theory.

Even though humans are primarily "visual" processing organisms, and much of this information is coded in memory, it should be realized that the visual information is not recorded as a "picture." Kaplan (1978) points out that:

> While the (cognitive model concept) may be equated in a very rough way with the idea that a person has a 'picture of the environment' in his head, the information is far more schematic and incomplete than 'picture' implies, to say nothing of the fact that this 'picture' will in general never have been seen all at once (p. 56).

The mental "picture" is an approximation to reality, an approximation that will vary according to individual experience level.

If, indeed, humans do formulate mental models of their environment, based primarily on visual encounters, then one could hypothesize that: on-site experiences in natural environments could be important in cognitive model development of such environments. In

addition, since much of the on-site information is processed visually, the use of photographs might be a logical approach for abstracting what visitors do perceive and record mentally during on-site encounters. Differences in recognition of what images become most familiar during on-site experiences could benefit resource planners and managers involved in providing visual resource experiences.

PREFERENCE - FAMILIARITY STUDY

During the summer of 1977, a total of 400 visitors were interviewed while visiting the bog environment of Cranberry Glades, Monongahela National Forest, West Virginia. Visitors had access to the bogs by way of an interpreted boardwalk trail. Some visitors were asked to view and rate black and white photographs of the bog resource just prior to a hike on the bog boardwalk and then again after the hike (fig. 1, group 1). Other visitors were shown the photographic questionnaire only upon completing their hike (groups 2 and 3). In both cases, visitors were asked to indicate their visual preference (on a 5-point Likert scale, ranging from 1 = preferred not at all to 5 = preferred very much) for each photographed scene. At the end of the hike, information was also obtained about visitors' feeling of how familiar various photographs seemed (groups 1 and 3). Familiarity was defined as the visitor's recall of having seen a scene or a photograph of it during the hiking experience. A 3-choice option (familiar, not familiar, not sure) was provided for recording familiarity. Information was also obtained about visitors' previous visits to the study area.

Photographs for the study questionnaire included some taken by visitors, some furnished by the interpretive staff of the Cranberry Glades and some furnished by the researcher. To obtain visitor photographs, 15 visitors to the bog were given instamatic cameras prior to the actual survey date and asked to photograph bog scenes and features as they hiked the trail. From the three sources (visitors, interpretive staff and researcher) of photographs, 24 photos were selected for inclusion in each of two versions of the questionnaire (see Hammitt 1978a, for a detailed description of methods and selection criteria for representative photographs). A few bog scenes from Michigan and from bogs adjacent to the study area were also included with the Cranberry Glade photographs for testing a portion of the familiarity component of the study.

FAMILIARITY AS A COMPONENT OF VISUAL PREFERENCE

What Visitors Remember

Visitors seemed to have little trouble determining which scenes they had seen and which they had not. For some of the bog scenes as many as 90 percent of the participants indicated they were "familiar" with the scene. Thus, visitors appeared to be quite cognizant of what they saw during the on-site bog experience. Far fewer participants used the "not sure" option than anticipated ($\bar{X}$ = 16 "pct"). The efficiency of participants' cognitive system for recognizing what they had seen was further demonstrated when visitors were able to recognize similar bog scenes from Michigan, or adjacent bogs near the study site, as having not been seen during the on-site

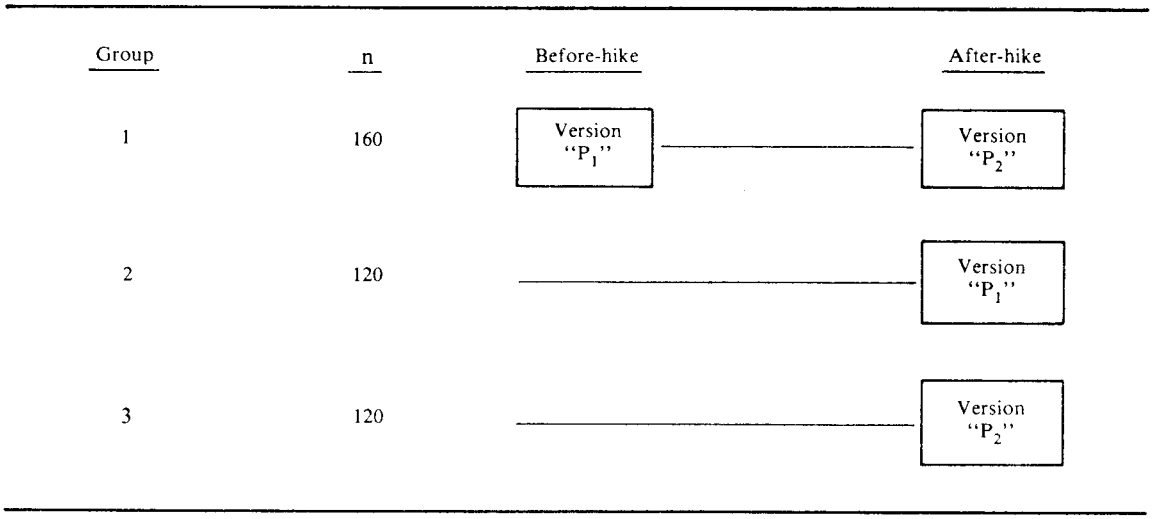

Figure 1. *Research paradigm for sampling bog visitors.*

Photo 36 93.4%

Photo 33 92.0%

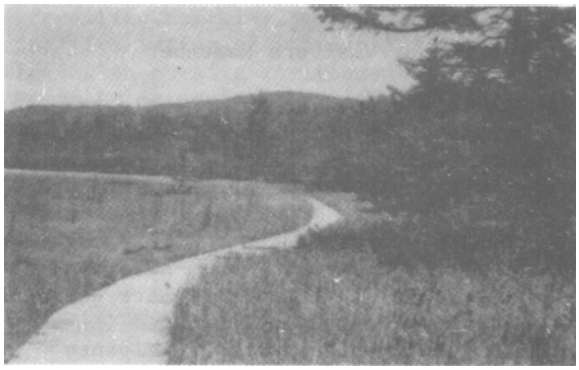

Photo 45 88.7%

Photo 31 86.5%

Photo 40 84.3%

Photo 47 79.2%

Figure 2. *Six most familiar bogscenes based on familiarity ratings.*

Photo 39 23.4%

Photo 27 29.9%

Photo 44 32.1%

Photo 35 33.6%

Photo 41 34.3%

Photo 42 38.0%

Figure 3. *Six least familiar bogscenes based on familiarity ratings.*

hike. [3/] Five of the six control or off-site photos were among the eight least familiar scenes.

Figures 2 and 3 show the six most and least familiar scenes, respectively, based on the percentage of "familiar" scores. Some interesting patterns emerge when one examines the scenes for elements which aid and hinder familiarity. The six most familiar or most remembered scenes are characterized by two main bog components, boardwalk and distinct features. All of these scenes are quite distinctive and identifiable, and as a consequence, visitors were quite sure as to whether they had viewed the scenes. The three "feature" scenes (photos 31, 40, and 47) are all landmarks along the boardwalk, while the boardwalk itself (photos 36, 33, and 45) is a dominant element in the visual pattern experienced during the hike.

Familiarity for the features and the boardwalk correspond well with the findings of Lynch (1960), Devlin (1976) and R. Kaplan (1976). Lynch found that two of the major components in the "sketch maps" of city dwellers were landmarks (features) and paths (boardwalk). Both Lynch and Devlin found these two components to be among the initial elements that people incorporate into their cognitive models. Only with additional experiences, over time, were details added to one's model. Kaplan, in the study of way-finding skills, states, "a critical component of these skills must be the capacity to identify distinctive aspects of the environment. Landmarks are vital to cognitive map development; their identification is enhanced when one is sufficiently well acquainted with the setting to know what is distinctive." Of course, the uniqueness, novelty and even function served by landmarks will have a bearing on how acquainted one must be with a setting to know what is distinctive. As will be discussed later, in the case of recognizing scenes which were seen during the hog hike, even a single experience seemed to be adequate.

The least familiar scenes tended to be those which lacked distinguishing features and/or were scenes which visitors, in fact, were unlikely to have seen during the hike. Photos 27, 44, and 42 were of a bog environment in Michigan and, thus, fall into the latter category. Scene 35, though on-site, was also probably not seen, due to visitor viewing orientation being concentrated opposite this edge scene, toward the open bog mat. Photos 39 and 41 represent a different story in that they were both distinct, novel and memorable scenes which the visitors did not see (#39) or due to the non-existence of a good orchid display during the 1977 summer (#41). Late frosts during the spring of 1977 caused the poorest flowering display of orchids at Cranberry Glades in recent years (USDA Forest Service 1977).

Influence of Prior Information and Visits on Familiarity

One might hypothesize that the viewing of photographic materials before an on-site experience, or familiarity with a setting through previous visits, would influence the ability to recall what had been seen during the on-site experience. The pre-post and control design of this study allows for investigating the first of these relationships. Even though group 1 viewed photographs (and rated them for preference) before the hike, they were at no apparent advantage over group 3 (who did not view photos before the hike) when both groups rated the photos for familiarity at the end of their hikes (rho = .97). The percentage scores were quite similar and only two photos (#38 and #48) were somewhat discrepant in their ranked position (table 1). The lack of influence of prior visual information on familiarity for scenes viewed during the on-site experience, indicates that the familiarity ratings were based on the on-site cognitive experience rather than on exposure to the prior photos.

The influence of prior visits on visual recall can be examined in terms of differences in familiarity scores for first-time visitors versus repeat visitors. Only one photograph showed any significant difference (chi-square test) in familiarity rating as the number of previous visits to the bog increased. Thus, it appears that a single on-site experience is sufficient for developing a sense of familiarity.

It is important to keep in mind that in this study only visual recall of on-site scenes was measured as an indicator of familiarity. This does not mean that repeat visitors might

[3/] Rating of the photos for preference and familiarity took place at the trailhead, in a forested area and out of sight of the photographed bog scenes. Thus, participants were required to recall what they had seen; it was impossible for them to see the scenes during the interview process. Visitors rated the photos 20 or more minutes after the hike began, as the boardwalk trail was ½-mile in length.

not be more familiar with the environment if other indicators of familiarity were measured. Nevertheless, it is important to know the degree to which visual information enters memory as a result of on-site experiences, for this certainly can be important in the initial phases of cognitive model development.

It is also intriguing that visitors were so very cognizant of the visual information they had processed while engaged in a recreational activity. The behavior of visitors while hiking the trail (or for that matter, participating in any other recreational activity) would lead one to believe visitors "are just having a good time and the acquisition of information is the last thing taking place." Yet, information processing theory predicts that visitors necessarily have an efficient cognitive system for "knowing" the natural environment.

Table 1 -- *Influence of prior photographic information on familiarity scores. Group one of bog visitors viewed photographs before the hike, group three did not.*

Frequency (percent) of "Familiar" Scores				
Photo No.	Group 1		Group 3	
	"pct"	rank	"pct"	rank
36	92.3	1	94.9	1
33	92.3	2	91.5	2
45	90.4	3	86.4	4
40	85.9	4	82.2	6
31	85.3	5	88.1	3
25	77.6	6	78.0	7
47	75.6	7	83.9	5
29	73.7	8	77.1	8
32	73.1	9	69.5	9
37	63.5	10	61.0	11
43	60.9	11	69.5	10
30	56.4	12	60.2	12
46	55.8	13	54.2	13
48	51.9	14	36.4	19
28	50.0	15	54.2	14
26	48.7	16	50.0	15
34	46.2	17	47.5	16
42	35.9	18	40.7	18
41	35.9	19	32.2	20
35	35.3	20	31.4	21
38	34.6	21	44.1	17
44	34.0	22	29.7	22
27	31.4	23	28.0	23
39	24.4	24	22.0	24

Familiarity and Visual Preference Relationship

When the preference and familiarity scores were ranked and compared, a positive relationship was revealed (rho = .53): figure 4. However, as figure 4 indicates, the majority of the scenes show a very strong relationship between familiarity and preference. The two scenes (photos 39 and 41) that were highly preferred but very low in familiarity have been encountered previously. Both scenes are feature oriented, but were not available for visitor viewing during the on-site hike (photo 39 is the oblique view and 41 the seasonal orchid view). Visitors liked the scenes and perhaps because they were distinctive, were quite sure they had not seen them on-site. Photo 40 represents the only instance of very low preference and yet high familiarity. This scene was of an uprooted tree, a negative feature in the pattern of boardwalk events, which visitors did not appreciate but had no difficulty recalling.

How might the relationship between familiarity and preference be explained in terms of environmental cognition and the mental models which humans develop during on-site experiences? "hen an environmental setting is non-district, featureless, and offers little opportunity for individuals to become visually involved, they might he expected to pay less attention or to pass more rapidly through such areas. In preferred environmental settings, they are likely to pay more attention and thus, increase contact and familiarity. Also operating along with greater attention for preferred scenes is the fact that one prefers the scenes that are more distinctive, that help in orientation as distinctiveness is easier to remember. Thus, an environmental scene high in the cognitive domains of "distinctiveness" and "involvement" is more likely to be attended, and such prolonged contact should enhance familiarity. It is further proposed that the enhanced familiarity is a component of cognitive model development during on-site engagements.

Although preference appears to lead to familiarity, a cautionary note is in order. While high preference for a scene tends to be associated with a high degree of familiarity for that scene, one is reminded that the opposite situation, of high familiarity being associated with low preference, can also occur. Familiarity can lead to increased preference, but familiarity, per se, is insufficient basis for appreciation. One can be very familiar with non-preferred aspects of an environment.

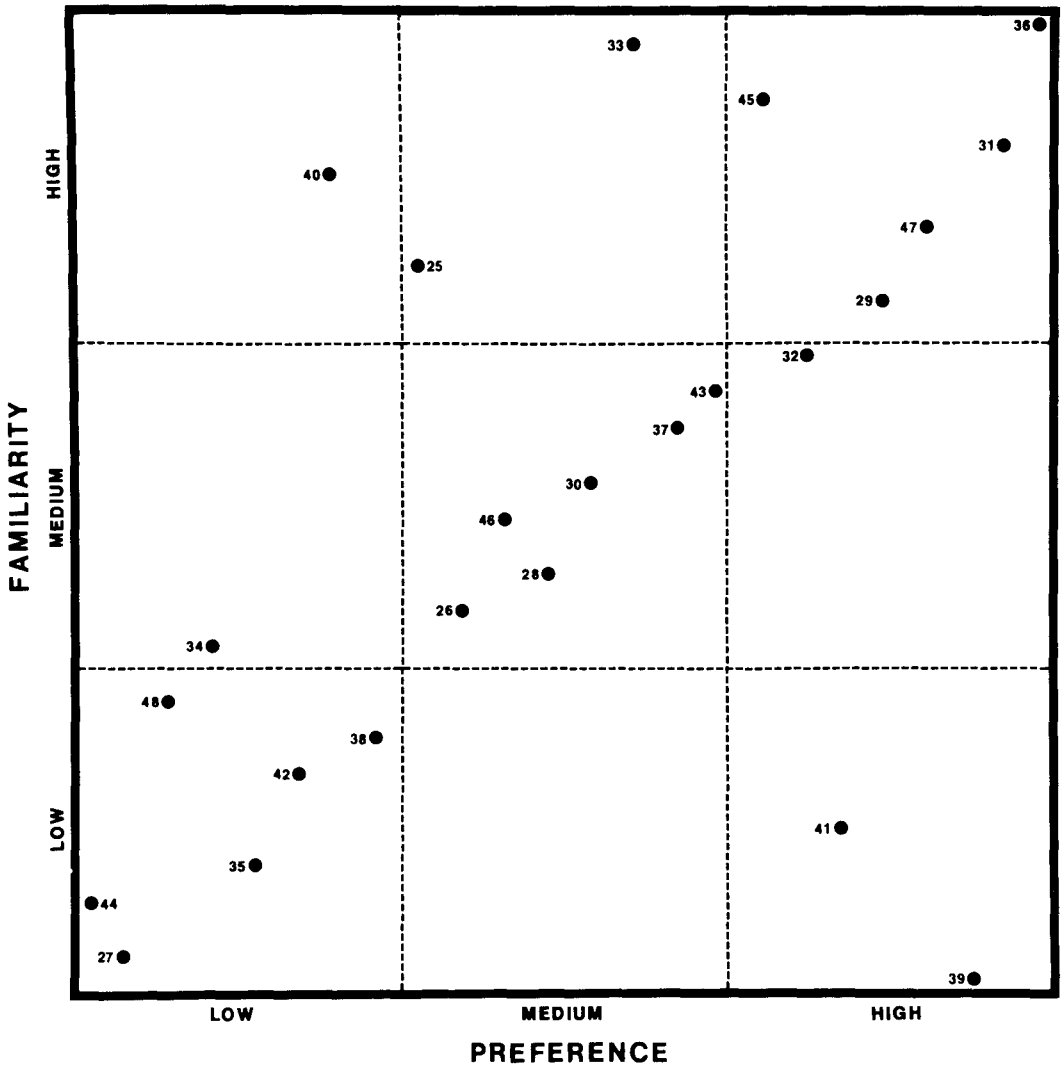

Figure 4 -- *Relationship of visual preference to familiarity for photographs of a bog (n = 274; rho = .53).*

SUMMARY AND CONCLUSIONS

Familiarity resulting from an on-site experience with a hog environment was studied in a number of ways. What do these reveal about familiarity resulting from encounters with natural environments?

Familiarity was examined in terms of people's ability to recall visual information which they had experienced. After lust one on-site experience, visitors were quite cognizant of what scenes they had viewed and had not viewed. Neither viewing of photographs before the on-site hike nor prior visits to the bog were shown to be of advantage in terms of visual information recall.

Comparison of familiarity ratings with preference ratings for the same scenes showed a positive relationship between the two variables. The photos which were most preferred by visitors were also most remembered, assuming visitors had a chance to view the actual scenes. The least preferred scenes were likely to be scenes with which visitors were not familiar, due to the photos being of an off-site bog. But, the relationship of preference and familiarity is more complex than that of a direct relationship.

It would appear that visitors are processing considerable visual information during on-site experiences in natural environments,

and that much of this information is entering memory, at least for a short while. It also appears that preferred environmental settings and scenes aid in the memory process. If this is true, planned and preferred environmental experiences could be quite instrumental in the development of cognitive models on the part of visitors to natural environments. As stated elsewhere (Hammitt 1978h), the importance of visual information processed as a result of on-site experiences in natural environments might be simply to predispose people to respond to further information--to provide people with the initial cognitive structures to incorporate future on-site experiences. After all, it is the continuing sequence of experiences that eventually underlies a person's thinking and behavior.

Some examples of how the visual preference-familiarity relationship might be operationalized by resource managers are: the design and lay-out of hiking trails, scenic car tours and even the development of environmental inter-pretive experiences. Areas can he field inventoried for distinct features and scenes which serve as landmarks, and have been shown to enhance familiarity. Situations, such as dense undergrowth or a low hanging branch, which serve as a visual harrier, lend them-selves to designing the "bend in the trail" where part of the visual information is hidden and offers the element of visual involvement. Students in an "Environmental Interpretation" class at The University of Tennessee had little trouble in incorporating both the distinctive and hidden information components into the lay-out of forest trails when given the assignment. Trails designed to include "visually preferred" as well as "ecologically preferred" information could offer the trail visitor a more rewarding experience. And, since the visually preferred is more likely to attract attention and be remembered, could it be that an interpretive message located at a preferred scene might likewise be more likely to be remembered. Such a possibility encourages further research.

While the reviewed technique and approach for measuring familiarity and preference of natural environments have the greatest application in planning and designing preferred environmental experiences, there are various other visual resource and land management situations to which it can be adapted. The fact that the methodology is quite economical, requires little statistical software and is an approach that involves on-site public involvement in the management of visual resources should encourage its future use. As inferred by Mercer, we have a long way to go in under-standing the mental maps of people, especially as these maps relate to the experiencing of visual and recreational resources.

LITERATURE CITED

Attneave, F.
1957. Transfer of experience with a class-schema to identification-learning of pat-terns and shapes. J. Exp. Psychol. 54:81-88.

Bruner, J. S.
1957. On perceptual readiness. Psychol. Rev. 64:123-152.

Devlin, A. S.
1976. The "small town" cognitive map: ad-justing to a new environment. In Environ-mental knowing: Theories, research, and methods. G. T. Moore and R. G. Gulledge, eds. p. 58-66. Dowden, Hutchinson, and Ross, Stroudsburg, Pa.

Downs, R. M. and D. Stea (eds.)
1973. Image and environment: Cognitive map-ping and spatial behavior. 439 p. Aldine Co., Chicago.

Hammitt, W. E.
1978a. Visual and user preference for a bog environment. 159 p. Ph.D. diss. on file at Sch. Natl. Resour., Univ. Mich., Ann Arbor, Mich.

Hammitt, W. E.
1978b. A visual preference approach to measuring interpretive effectiveness. J. Interp. 3(2):33-37.

Kaplan, R.
1976. Way-finding in the natural environment. In Environmental knowing: Theories, research, and methods. G. T. Moore and R. G. Golledge, eds. p. 46-57. Dowden, Hutchinson, and Ross: Stroudsburg, Pa.

Kaplan, S.
1978. On knowing the environment. In Human-scape: Environments for people. S Kaplan and R. Kaplan, eds. p. 54-58. Duxbury Press; North Scituate, Ma.

Kaplan, S. and R. Kaplan (eds.)
1978. Humanscape: Environments for people. 480 p. Duxbury Press, North Scituate, Ma.

Lynch, K.
1960. The image of the city. 194 p. MIT Press, Cambridge, Ma.

Mercer, D.
1975. Perception in outdoor recreation. In Recreational geography. Patrick Lavery, ed. p. 51-69. Halsted Press, New York.

Moore, G. T. and Golledge, R. G. (eds.)
1976. Environmental knowing: Theories, research, and methods. 441 p. Dowden, Hutchinson, and Ross: Stroudsburg, Pa.

Shafer, E. L., Jr.
1969. Perception of natural environments. Environ. Behav. 1:71--82.

Tolman, E. C.
1948. Cognitive maps in rats and men. Psychol. Rev. 55:189-203.

U.S. Department of Agriculture, Forest Service
1977. Personal communication. Cranberry Glades Botanical Area staff. Monongahela Nat. For., West Va.