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ABSTRACT

AN INTERACTION TRAVEL MODEL FOR PROJECTING ATTENDANCE OF CAMPERS AT MICHIGAN STATE PARKS: A STUDY IN RECREATIONAL GEOGRAPHY

by Carlton S. Van Doren

To evaluate existing and potential outdoor recreation areas, a number of economic and social values must be estimated. A primary objective of this work is to design a suitable method for approximating some of these values on the basis of recreation area characteristics and the desires of the users. The specific problem is to understand the spatial variation in camper attendance at Michigan State Parks in 1964. Three steps are included in the analysis.

The first step involves classifying each state park in terms of its attraction as a trip destination. Three attractive qualities are considered: 1) natural resources, 2) outdoor activity opportunities, and 3) facilities and services available. The extent and quality of the variables included in these three elements are combined into an attraction index for each

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state park by the use of factor analysis and a scoring routine using the factor loadings. The index of camping attraction provides a classificatory system as well as a measure of the camping opportunities and allurement each park holds for campers.

The camping attraction index is derived without a consideration of visitation rates, a measure frequently utilized as an estimate of the satisfaction provided by a recreation site. A second step uses regression analysis to compare the relationship between attendance at parks (camper-days) and the attraction indices. This test substantiates the validity of the attraction indices as a measure of potential camping satisfaction.

A third and final step includes the use of the attraction indices as one of three components in a recreational travel model. An interaction or gravity model is utilized. In addition to the destination component or attraction indices, other components are the number of camper-days originating from each of eighty-eight origin nodes and the automobile travel-time between the origins and fifty-nine park destinations. A successful replication of the system is achieved

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The travel model and its specialized component, the camping attraction indices, can be used as a predictive tool for estimating the camping use of existing or proposed recreational sites as well as providing insight into the site and situational characteristics of the state parks.

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AN INTERACTION TRAVEL MODEL FOR PROJECTING ATTENDANCE OF CAMPERS AT MICHIGAN STATE PARKS: A STUDY IN RECREATIONAL GEOGRAPHY

by

Carlton S. Van Doren

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Geography

1967

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I wish to express my thanks to my advisor, Professor Donald A. Blome, for his support, advice, and criticism in the preparation of this dissertation. A similar expression of gratitude is due the members of my advisory committee, Professors D. H. Brunnschweiler and L. M. Sommers. An acknowledgment is also due to Professor D. N. Milstein for his many helpful suggestions and the encouragement he gave me in my attempt to create a recreational travel model. I am deeply grateful to Professors Milstein and L. M. Reid of the Department of Resource Development, Michigan State University, for the financial assistance extended to me from the Michigan Outdoor Recreation Demand Study. In addition, I am further indebted to D. L. Gibson, director of the Institute for Community Development and Services, Michigan State University, for the financial aid received during my tenure as a graduate student. Without the faith and confidence of these gentlemen, this work would not have been completed.

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For help during the latter phases of my writing, my thanks should be extended to Mrs. Ree Sheck, who carefully read my drafts, and to Mrs. William Neeld of Columbus, Ohio, who so capably typed the dissertation. Moral and financial support was also received from Professor Edward J. Taaffe of The Ohio State University. As a close confidant during the last stages, he had the ability to make me smile while in the throes of preparing the final draft. Mr. Charles E. Trott assisted in the preparation of the illustrations.

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CHAPTER I

INTRODUCTION

The post-war increase in outdoor recreational activities has not only necessitated the improvement and enlargement of many established recreation sites, such as state and national parks, but has also created a need for new recreational sites. With few exceptions, the proposed sites for these new developments are appraised for their economic and social feasibility. In the process of evaluating potential outdoor recreation areas, a variety of values must be estimated, such as the physical attributes which would complement the activity desires of potential visitors. Where would visitors come from to utilize the site and in what numbers? How far is the consuming public willing to travel to reach a recreation facility? With the limited data available, these values cannot be satisfactorily estimated v

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estimated without "heroic assumptions."[1] The primary objective of this research is to design a suitable method for approximating these values.

In utilizing the natural resource base for outdoor recreational purposes, man should identify and classify the precise character of natural and cultural phenomenon involved. The need for such an analysis was stated more than a decade ago in American Geography: Inventory and Prospect.

> There is great need in the new field of recreational study for careful analyses of recreational areas for the purpose of depicting and explaining the patterns both of recreational structures and recreational activities.[2]

This analysis should include, as emphasized above, not only "recreational structures" but "activities." A

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[1]The author was a member of research teams assessing the feasibility of two national lakeshore recreation areas in Michigan. The association with these research teams and a recognition of assumptions necessary for projecting the magnitude and source of potential visitors gave the initial impetus for this dissertation topic. For a discussion of the methods used to predict visitors to these two lakeshore recreation areas, see Institute for Community Development and Services, Report on the Economic Feasibility of the Proposed Sleeping Bear National Seashore, prepared for the National Park Service (East Lansing: Michigan State University, 1961), and Institute for Community Development and Services, The Proposed Pictured Ricks National Lakeshore, An Economic Study, prepared for the National Park Service (East Lansing: Michigan State University, 1963).

[2]Preston E. James and Clarence F. Jones, eds., American Geography: Inventory and Prospect (Syracuse University Press, 1954), p. 255.

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recreational resource must be viewed as a resource useful to man, and public allocation of recreational resources should therefore be made with the potential users' desires in mind.[3] Opportunity for outdoor activities as the motivation for traveling to and using a recreational area will be a major premise in this work.

Recreation sites or phenomena[4] have varying physical attributes and activity opportunities that offer man a wide selection of where to undertake outdoor activities. Man's use of specific recreation sites is measureable in the aggregate by attendance figures, and these figures have been used frequently as a measure of the satisfaction derived at those recreational sites studied.

An analysis of the spatial variation of attendance

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[3]Recreational resources are functional in that they satisfy a human want. This notion is in accordance with Zimmermann's definition of a resource. "The word 're-source' does not refer to a thing or a substance but to a function which a thing or a substance may perform or to an operation in which it may take part. . . ." Eric W. Zimmermann, World Resources and Industries (New York: Harper & Brothers Publishers, 1951), p. 7.

[4]"Recreational phenomena are of three kinds: 1) the peculiar associations of physical and biotic conditions that people think are conducive to recreation and which, therefore, constitute natural recreational resources; 2) the structures and other facilities that represent capital investment for recreational purposes; and 3) the recreational activities themselves." James and Jones, op. cit., p. 252.

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at recreation areas provides an initial level for analyzing and explaining man's perceptions of recreational resources and activity opportunities. Behavior patterns are evident--some outdoor activities occur at specific recreation sites and not at others--but the many human motivations that are influential in the selection of one recreational site as opposed to another cannot be empirically evaluated. The combinations of natural resources and outdoor activity opportunities in a recreation area can, however, be subjectively analyzed. From such an appraisal, insights may be obtained to explain the spatial variation in attendance for a specific outdoor recreational system.

This study is addressed to the problem of understanding the spatial variation in camper attendance at Michigan State Parks (Figure 1). The research is built upon accepted notions of natural and man-made attributes necessary for camping in state parks as well as travel characteristics of visitors to state parks. Generalizations drawn within the framework of these assumptions are synthesized into a behavioral travel model that can be used to analyze the spatial structure of camping in this extensive state park system. A component of the

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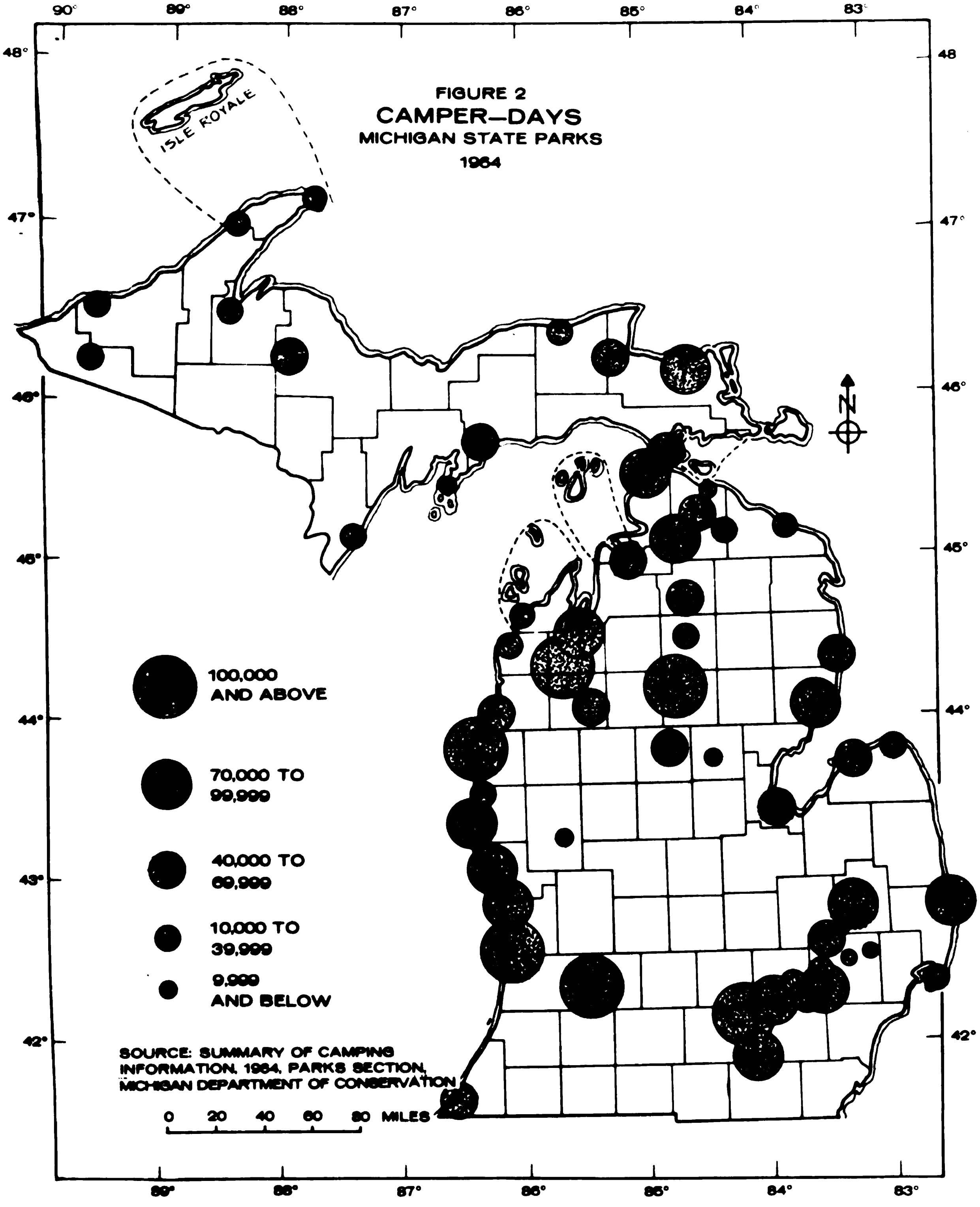
travel model classifies each state park for camping. The component, combined with known distance relationship between the origins of campers and parks, is used to simulate the movements between destinations (Figure 2) and origins (Figure 3) of campers. By projecting campers' choices of parks made from recreation facilities offering different activity opportunities and varying resource qualities, the model provides a tool for analyzing the site and situational characteristics of parks. This attempt to classify and rate recreational space and thus predict park attendance sets this model apart from other recreational travel models.

Chapter II provides an appraisal of some of the methods that have been utilized to estimate attendance at recreation sites in a spatial context. Attention is focused on interaction models that have been found useful for estimating consumer spatial behavior. Some of these constructs have made use of indices of accessibility or of attraction. In utilizing the services offered in a state park, the camper is in essence a consumer, just as a shopper in a retail center. The same concepts that have led to the development of consumer interaction models may well be applied to travel models in estimating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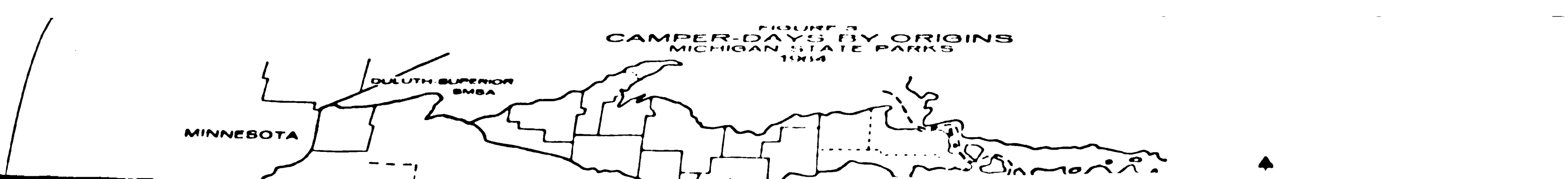

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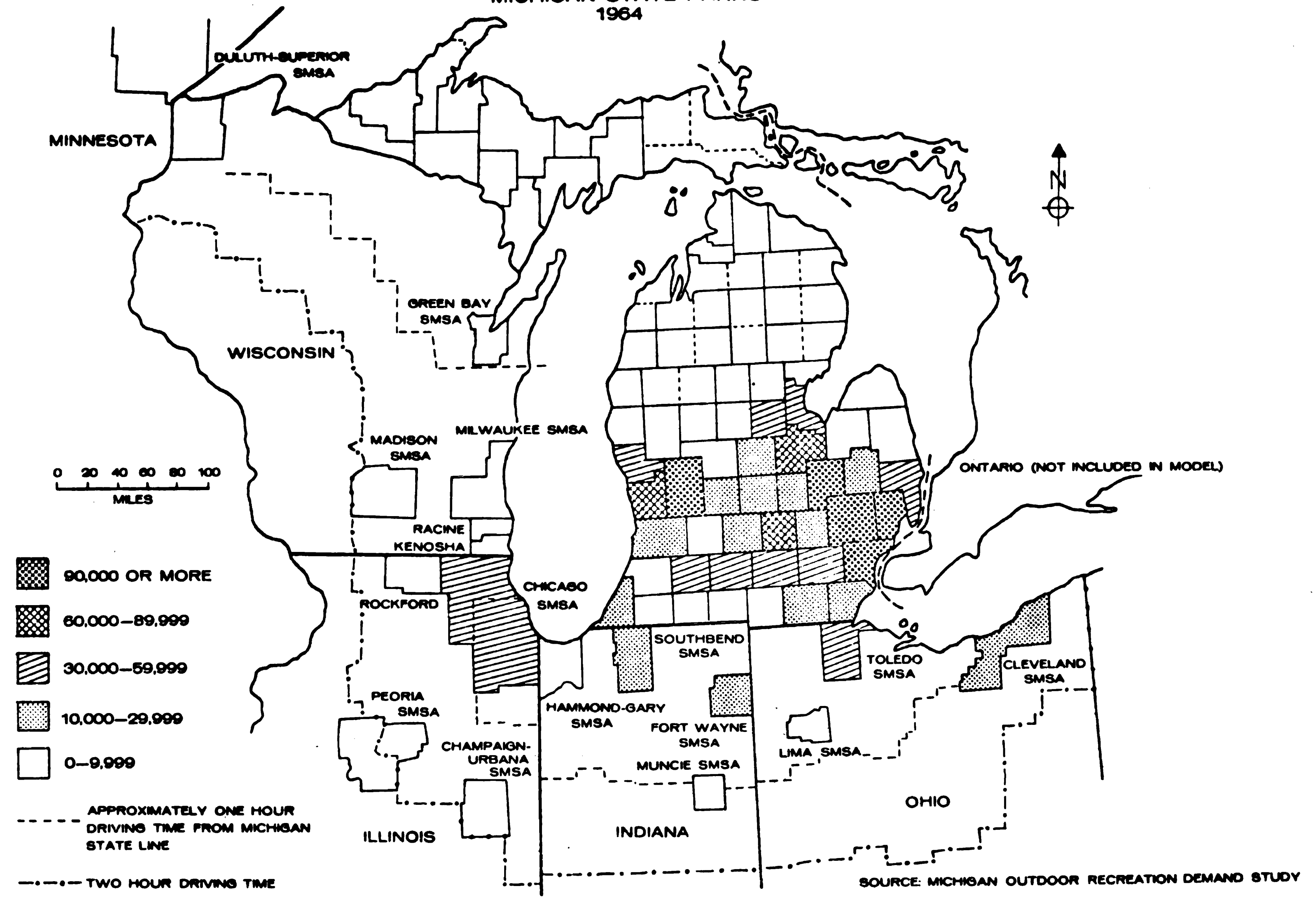

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the appeal a specific activity holds for visitors to state parks. Therefore, the notion of indexing the retail attraction of a shopping center is selected for application to an activity-centered recreation travel model.

Three components for a recreation travel model are identified in Chapter III: (1) destination areas or state parks, (2) origin areas of the visitors, and (3) automobile travel-time between origin and destination. The elements of a camping attraction are identified and discussed--the activity preferences of campers, the natural resources of the parks, and the facilities and services. The basis for selection of the variables in each group is given in a brief review of literature on planning and development of outdoor recreation areas. Much of the chapter is devoted to a discussion of outdoor activity preferences of campers, accepting preferences as primary motivation for choosing a particular park, and to the relationships between activity preferences and the quality of natural and man-made resources complementing activity preferences.

In Chapter IV a method for combining the natural and man-made resource variables into an attraction index for each park is demonstrated by the use of factor analysis.

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analysis. This procedure yields a system for classifying the extent and quality of a combination of natural and man-made resources of each state park. The values derived are then combined into an overall index of camping attraction, including a measure of the opportunity for various outdoor activity preferences of campers as well as the camping capacity of each park. These indices are assumed to be a measure of the camping allurement of each park and also a reflection of the potential enjoyment derived by campers. Estimates of the satisfaction derived by visitors to a recreation site are frequently made by attendance. The camping attraction index, derived without consideration of visitation rates, is at this point put to a severe test as a measure of expected camping pleasure. This test is conducted by comparing the relationship between camper-days[5] at each park for a season (a calendar year - 1964)[6] and the park indices by means of a regression analysis.

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[5]A camper-day is equivalent to one person camping one night and is considered to equal one day of camp use.

[6]Data availability determined the type of outdoor activity utilized for the attraction index. The only complete count which included the origin and destinations of visitors to Michigan State Parks was made in 1964 from camping permits.

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The interaction model for camping activity flows to Michigan State Parks is described and tested in Chapter V. All the parameters of the various models, with the exception of time-distance, are varied in a number of tests. The relative measure of a successful model is based on the best replication of 1964 camper-day figures at each park and from each of the eighty-eight origins. The projected total camper-days are compared with actual camper-days at each park by a root-mean-square (r.m.s.) error. The results of the r.m.s. error support the use of the interaction model with the addition of a specialized component, the camping attraction indices.

A summary of the work in the last chapter also suggests the implications of the study for recreational geography and recreational resource planning. The use of the interaction model as a predictive tool for estimating the use of existing or proposed state parks for camping is discussed along with its limitations. The chapter concludes with the view that this investigation is one step in an attempt to understand the site and situational characteristics in the use of recreation areas.

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CHAPTER II

APPRAISAL OF THE ELEMENTS OF SITE AND SITUATION FOR RECREATIONAL AREAS

Economists have made a significant contribution in calculating the value of specific outdoor recreation resources and projecting attendance by the use of demand curves.[1] These curves have reflected the interaction between two variables--the total cost of the outdoor activity and the number of visitors originating at varying distances from the recreation site. Such curves provide an estimate of the value of the recreational

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[1]A few examples of these demand studies are Marion Clawson, Methods of Measuring the Demand for and Value of Outdoor Recreation (Washington: Resources for the Future, 1959); U. S. Outdoor Recreation Resources Review Commission, Economic Studies of Outdoor Recreation, Study Report 24 (Washington: U. S. Government Printing Office, 1962); and E. Boyd Wennergren, Value of Water for Boating Recreation, Bulletin 453 (Logan: Agriculture Experiment Station, Utah State University, June, 1965). Using Clawson's method, the author measured the demand for outdoor recreation at a federal reservoir on the Missouri River. See John S. Evans and Calrton S. Van Doren, "A Measurement of the Demand for Recreational Facilities at Lewis and Clark Lake," South Dakota Business Review, a supplement, XVIII, No. 3 (February, 1960).

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resources *per se*, thus measuring the value of the experience by total attendance. By varying the assumptions used in these consumption curves, one can predict attendance at particular sites.

These pioneering ventures have excluded precise measurement of human attitudes and reactions to recreation resource characteristics and have unrealistically assumed that an outdoor experience is the same for all participants.[2] Individual outdoor activity preferences requiring a variety of natural resources have been neglected. Neither have the economists' demand models emphasized importance of the spatial distribution of recreational areas.

Not all recreational areas offer the same activities, physical resources, and developed facilities. Furthermore, the spatial distribution of recreational sites is very influential in determining the amount of use that

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[2]Ullman and Volk developed an operational demand model for predicting attendance at reservoirs in Missouri. Their model, based on a regression analysis, does not include a consideration of site characteristics at the reservoirs. Edward L. Ullman and Donald J. Volk, "An Operational Model for Predicting Reservoir Attendance and Benefits: Implications of a Location Approach to Water Recreation," *Papers of the Michigan Academy of Science, Arts and Letters*, XLVII (1962), p. 473.

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each site receives. The model developed in this work is an attempt to investigate separately the spatially varying intensities of use, resource attributes, and activity opportunities.

Recreation Travel Models

Travel models for recreation have been suggested; a few have been attempted. In discussing the location and use of recreational areas, Perloff and Wingo have stated:

> Normally, a consumer will use a given facility at a rate related to its distance from his home: the more remote it is, the less he will tend to use it. Or, given several comparable facilities, all other things being equal, he will use the nearer more frequently than--or to the exclusion of--the more remote.[3]

Perloff and Wingo have suggested an interaction model to project travel to recreation sites.

> The counterpart of accessibility is "demand potential." This can be viewed as a so-called "gravity" model in which is incorporated the tendency of demand for a service to vary inversely with its distance from the consumer.[4]

A similar model of this type has been suggested by Clawson

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[3]U.S., Outdoor Recreation Resources Review Commission, Trends in American Living and Outdoor Recreation, Study Report 22 (Washington: U. S. Government Printing Office, 1962), p. 91.

[4]Ibid., p. 98.

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in a diagram showing the connectivity between urban centers of different sizes and various distances from parks.[5] In predicting the demand for outdoor recreation in the Los Angeles Metropolitan Area in 1976 and 2000, Case and Levin also suggest the use of a "gravity" model in selecting optimum locations for recreation sites.[6]

Interaction Models

Considerable work has been done with interaction models for urban land uses, particularly retail activities. Admittedly, there are differences between retail travel behavior and recreation travel behavior, but some of the basic notions used in the retail models are applicable for this study. One purpose of this chapter is to explore the similarities between urban travel models and recreational travel models and to show their utility to this particular topic.

Interaction models as applied to human movements have developed from an analogy with Newtonian concepts of gravitation. These concepts view a region as a mass

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[5]Marion Clawson, Land and Water for Recreation (Chicago: Rand McNally and Co., 1963), p. 48.

[6]U. S., Outdoor Recreation Resources Review Commission, The Future of Outdoor Recreation in Metropolitan Regions of the United States, Study Report 21, Vol. III (Washington: U. S. Government Printing Office, 1962), p. 103.

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structure in accordance with principles that constrain or initiate action of the individual particles. Spatial inter-connections are viewed as interactions between masses where population is used as a measure of mass.

The traditional "gravity" or interaction hypothesis,[7] is

$$I = \frac{P_1 P_2}{d^x} \qquad (1)$$

where I is directly proportional to the product of two populations, P_1 and P_2, and inversely related to the exponential function of the distance between them, d^x. A large number of empirical studies have shown the promise of interaction models for analyzing various spatial inter-connections.[8] The measure of "mass" used has depended on the problem studied, for example

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[7]This is the general form used by Stewart in his initial work. John Q. Stewart, "An Inverse Distance Variation for Certain Social Influences," Science, XCIII (1941), pp. 89-90.

[8]A detailed discussion of the development and application of these models may be found in Gerald A. P. Carrothers, "An Historical Review of the Gravity and Potential Concepts of Human Interaction," Journal of the American Institute of Planners, XXII (Spring, 1956), pp. 94-102.

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[13]*Ibid.*

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commodity output,[9] retail sales,[10] floor area in apparel, and workers employed.[11]

Traffic engineers, urban planners, and sociologists have refined "gravity" or interaction models to predict traffic flow. Prominent among these groups has been Voorhees, whose "General Theory of Traffic Movement"[12] is basic to this research topic. Voorhees' concept is "that all trips emanating from a residential area are attracted, or 'pulled' to various land uses in accordance with specific empirical values."[13] Voorhees, using a gravity model,[14] demonstrated this idea in research of shopping habits. It was determined that the travel time

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[9] William Warntz, Toward A Geography of Price (Philadelphia: University of Pennsylvania Press, 1955).

[10] Both Chauncy D. Harris and Edgar S. Dunn used retail sales as measuring mass. See Chauncy D. Harris, "The Market as a Factor in the Localization of Industry in the U.S.," Annals of the Association of American Geographers, XLIV (December, 1954), pp. 315-348; Edgar S. Dunn, "The Market Potential Concept and the Analysis of Location," Papers and Proceedings of the Regional Science Association, II (1956), pp. 183-194.

[11] Alan M. Voorhees, Gordon B. Sharpe, and J. T. Stegmeier, Shopping Habits and Travel Patterns, Special Report II-B (Washington: Highway Research Board, 1955).

[12] Alan M. Voorhees, "A General Theory of Traffic Movement," 1955 Proceedings of the Institute of Traffic Engineers, October, 1955, p. 46.

[13] Ibid., p. 56.

[14] Voorhees, et al., op. cit.

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between a residential area and a shopping center is not the only criterion for selecting one store as opposed to another. The additional criterion is the competitive relationship among various stores or shopping centers in terms of the amount of retail floor area. By using this measure rather than population or attendance as a means of rating the attraction of a shopping center, the interaction model gave more realistic projections. Thus modified, equation one of the model becomes

$$I_{ij} = \frac{A_j P_i}{d_{ij}^x} \qquad (2)$$

where A_j is an empirical measure of the attraction or pulling power of a shopping center.

It is assumed that a similar equation can be applied in this study; that is, each state park has an empirically derived value, A_j, that will describe certain site characteristics that attract campers. Measuring the mass attractive qualities of parks has been a major problem for park planners.

Interaction Models for Recreation Trips

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Crevo[15] and at Yellowstone National Park by Cavanaugh.[16] Theoretical trips were predicted by Crevo in a manner similar to equation one; an attraction value for each park was not used. Cavanaugh's assumptions were similar. He assumed that the cars entering Yellowstone should be proportional to the population of the state of origin divided by the distance from the national park, or P/D. Cavanaugh postulated that the first P in the P_1P_2/D formula could be dropped because the mass of the park in question was the same for all visitors entering the park. Catton,[17] on the other hand, believes Cavanaugh was in error by making this assumption because one could expect different parks to vary in their attractive mass.

Catton used an interaction model to project the rate of interaction between visitors from the forty-eight

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[15]Charles C. Crevo, "Characteristics of Summer Weekend Recreational Travel," Highway Research Record, No. 44, Highway Research Board Publication 1161 (Washington, 1963), p. 51.

[16]Joseph A. Cavanaugh, "Formulation, Analysis and Testing the Interactance Hypothesis," (unpublished Ph.D. dissertation, Department of Sociology, University of Washington, 1950).

[17]Cavanaugh's work dealing with national parks is discussed in William R. Catton, Jr., "The Concept of 'Mass' in the Sociological Version of Gravitation," Mathematical Explorations in Behavioral Science, eds. Fred Massarik and Philburn Ratoosh (Homewood, Illinois: Richard D. Irwin, Inc., 1965), p. 294.

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states and selected national parks. He assumed that different parks have varying degrees of an attractive mass. To account for variations in the park mass, he indexes each park by a measure of population--specifically, annual visitor-days. He concludes that visitor-days as a measure of mass are inappropriate in an interaction model; that it is the "sacredness" (preservation of a natural area as nearly unchanged as possible) of national parks that constitutes their attractive force. He found a closer relationship between expected and actual visitor rates to western national parks by using a derivation of Kepler's Law and a measure of "sacredness" as a substitute for mass.

National and state parks have generally been established because of unique or scenic natural attributes desirable for preservation in an unaltered state. It is the extent of the resource qualities that help to make a park attractive. The notion that the natural resources of a park do constitute part of its attraction is developed in this travel model, though it is formulated on a probabilistic basis. Huff[18] believes

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[18]David L. Huff, "The Use of Gravity Models in Social Research," Mathematical Explorations in Behavioral Science, op. cit., p. 317.

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differences among individuals and variations in environments can bring about different forms of spatial behavior. He recommends the formulation of a probabilistic model that "would seek to determine the likelihood of movement from a given point of origin to various potential sources of destination for any type of spatial interaction."[19]

In reference to Catton's work, Huff states that if one is given a set of alternative choices for a type of spatial interaction (in this case parks), and if these choices are representative of an individual's tastes and preferences, then the selection of one park by that individual reflects its "utility." Thus, the properties of a park play a part in measuring its utility or "payoff" to the visitor. Therefore, if each park is assigned an empirical value that reflects a specific type of spatial interaction, this value can be used in a model to project the probability of traveling to a number of parks.

Huff recommends the use of park size (acres devoted to recreational purposes) as an empirical measure of

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[19] Ibid., p. 319.

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[20]Ibid

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park utility.[20] This suggestion stems from his work in predicting flows to shopping centers, where the retail floor area of shopping centers is used as a measure of mass or attraction.[21] The parallel between "pulling" power of shopping centers and state parks can be justified by comparing the objectives of the two trips involved.

Voorhees and Huff have incorporated the results of mass consumer preference studies into their travel models with success. Huff[22] has analyzed the social, economic, and psychological factors affecting the space preferences of consumers for particular products. His work has been primarily concerned with retail products which have a competitive market structure involving pricing and market feedback. In the case of camping, such a feedback is expressed in terms of individual or group satisfaction achieved while camping at a park. If the camping experience is unsatisfactory, the camper (consumer) will leave the park and probably stay away in the future.

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[20] Ibid., p. 320.

[21] David L. Huff, "A Probabilistic Analysis of Shopping Center Trade Areas," Land Economics, XXXIX (February, 1963), p. 81.

[22] David L. Huff, "A Topographical Model of Consumer Space Preferences," Papers and Proceedings of the Regional Science Association, VI (1960), pp. 159-173.

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The consumer shopping trip and the camping trip both require an investment in time and money, both are undertaken with a specific objective in mind. Consumers of retail goods initially order their choice of a shopping center according to their trip objectives and the number and type of products offered at alternative sites. It is assumed that campers have the same opportunity to make choices between state parks which offer varying resources and activity opportunities.

If the assumption that campers do choose between parks with varying resources and activity opportunities is correct, then parks offering a wide range of activity opportunities or resources and activity opportunities of superior quality should be more attractive than parks that do not provide such opportunities. Just as the diversity of stores in a shopping center benefit the customer by reducing time and cost traveling between stores, so does a variety of activity opportunities in one park benefit the camper. Shopping behavior patterns indicate a "pulling" power when sets of retail functions exist.[23]

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[25]Ibid

exist.[23] Parks, like shopping centers, may exhibit similar linkages by offering a number of outdoor activities within a high quality environment.

Attraction Qualities of Recreation Sites

Clawson's[24] generalized description of the whole outdoor recreation experience substantiates the idea that campers are activity oriented and that site and situational characteristics of a park are important. Such an experience consists of five clearly separate phases: (1) anticipation, (2) travel to, (3) on site, (4) travel back, and (5) recollection. About the "travel to" experience Clawson states:

> In order to reach the outdoor recreation area of its choice, a family must travel. Considerable expense is involved in such travel, and often as much time is consumed in travel as later on the site.[25]

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[23]The proposition that retail stores are arranged into shopping centers of various sizes by entrepreneurs to meet the desires of customers to combine shopping trip purposes has been studied by John D. Nystuen, "Geographical Analyses of Customer Movements and Retail Business Location: (1) Theories, (2) Empirical Patterns in Cedar Rapids, Iowa, and (3) A Simulation Model of Movement" (unpublished Ph.D. dissertation, Department of Geography, University of Washington, 1959).

[24]Clawson, *op. cit.*, p. 41.

[25]*Ibid.*, p. 40.

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[26] Ibid.

[27] ORRRC

But the "on site" experience is the real payoff for the outdoor experience. It is characterized by Clawson in this manner:

> When it [the family] arrives at the recreation site, the family may engage in many activities. Bodies of water are especially valued for outdoor recreation. The activities at the site generally provide the basic purpose of the whole experience, even when they occupy less than half the time and require less than half the total expense.[26]

Perloff and Wingo also believe that outdoor activities are the primary focus of the outdoor experience and succinctly state the relationship between activities and site characteristics:

> In the system we are describing, activities are the fulcrum which fixes the overall relationship of the recreation propensities of outdoor recreation groups to the array of facilities which are in different degrees available to users. They relate in specific ways to the behavioral patterns of the outdoor recreation groups and each has certain requirements for the nature of the facilities that support it.[27]

State parks for camping may be viewed as recreation centers that offer a range of outdoor activities for visitors. If campers are truly activity oriented as Clawson believes, then a state park's attractiveness to

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[26] *Ibid.*, p. 40.

[27] ORRRC Report 21, *op. cit.*, p. 89.

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a camper will partially depend on the activities that can be undertaken. A major portion of this work is devoted to the development of a measure reflecting a park's attractive mass, A_j. Such a measure has been called for but has not been developed for use in a travel model. Clawson and Knetsch have recommended the development of a "rating scale" of attractiveness as a major need for considering recreation supply problems.

> One line of research on recreation supply is to develop rating scales, or systems, to measure the inherent attractiveness of different outdoor recreation areas. Even the most casual observation shows that some areas are much more attractive than others; often, however, differences are not as clear or lack some kind of specific description or measurement. . . . It seems entirely possible to develop specific and rather objective rating scales for different kinds of outdoor recreation areas, for different uses of each, that would have great utility in planning, in research, and in administration.[28]

This underlines the complexity of planning and developing outdoor recreation sites. Supplying the public with a scenic site, although important, is not enough. Services and facilities must also be supplied, and the entire recreation entity planned for outdoor activities preferred by its users.

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[28]Marion Clawson and Jack L. Knetsch, Outdoor Recreation Research: Some Concepts and Suggested Areas of Study (Washington: Resources for the Future, Inc., Reprint Series, 1963), p. 261.

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Assuming that outdoor activities are the focal point of a state park for camping, then the preferences of campers for various outdoor activities must be identified, a task which has not as yet been adequately done. Clawson has described the need for user activity-preference patterns:

> We know all too little about why different persons seek outdoor recreation, or what they hope to gain from it. Too often, we have thought of recreation administration and management in terms of the physical area, and not enough in terms of the using public. Just as modern marketing theory is turning to a study of what the consumer wants, expects, and is willing to pay for, so must modern recreation administration turn to a study of its consumers.[29]

This informational gap provides a major obstacle in constructing a camping index. Elements other than outdoor activity opportunities which should also be included in an aggregate measure of attraction are environmental characteristics and facilities and services of the recreation site. The variables included in these two elements can be identified, but rating them for use in an index is more difficult.

In the next chapter the activity preferences of

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[29]Leslie M. Reid, Outdoor Recreation Preference--A Nationwide Study of User Desires (Department of Resource Development, Michigan State University, East Lansing, Michigan, by the author, 1963), p. 17.

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campers are identified as determined in national and state reports and surveys. Each outdoor activity preferred by campers is assigned a numerical rating. After the activity opportunities at each Michigan State Park are recognized, the activity preference values are assigned to each park. Totalling these activity preference values for each park develops an outdoor activity rating for camping. This rating scale provides a measure of the activity attraction of parks and serves as one element in the attraction index, A_j.

Elements number two and three, the natural resource characteristics of each park and the facilities and services provided, contain many variables of different qualities. In the next chapter, selection of many of the variables included in these two elements is justified on the basis of recreation planning and research reports. A scoring routine is used to combine all three elements into a camping attraction index.

Summary

This review of previous attempts to describe outdoor recreational systems has concluded with the idea that site and situational characteristics have not been considered

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considered in combination. Most statements have included elements of the location of recreational areas with little or no regard for site characteristics and the activity desires of participants. The models developed by economists to predict attendance at recreational sites, given as examples of this type, have ignored the internal characteristics of individual recreation areas and the activity opportunities available.

Previous attempts to use interaction models for recreational trips have indicated the need for deriving a measure of the mass attraction of each park independent of attendance. A discussion of the basic assumptions of interaction hypotheses led to an analysis of the parallels between the attractive qualities of shopping centers and those of state parks. One component of an interaction model for recreational sites could be a measure of the internal park characteristics and its activity opportunities. Such a measure or index is not too different from the attraction measures used for retail location models. The need for such a measure or rating scale for recreation areas has been recognized but none have been developed.

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recreational areas in a travel model is valuable in two ways. First, by using an attraction index rather than population or attendance to demonstrate demand for an activity, in this case camping, both behavioral and physical characteristics can be used to project use at existing or proposed parks. Second, the attraction index has a basic use in evaluation of a resource site independent of a travel model.

The following chapter identifies and defines the components of an interaction travel model and analyzes the elements of the attraction index and the selection of the variables associated with each element.

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CHAPTER III

COMPONENTS OF AN INTERACTION MODEL FOR MICHIGAN STATE PARKS

Interpretation and analysis of a statewide recreational system requires a knowledge of the spatial pattern resulting from the complex interaction between people, facilities, resources, time, and space. The physical supply of recreational resources must be matched with the spatial demand for the facilities. A recreational travel model that recognizes the "connectivity"[1] between two or more unlike points in space involves three components:

1. Supply: The destination areas (state parks), designated A.
2. Demand: Origin areas (campers represented by nodal population centers), designated P.
3. Distance between 1 and 2, designated TD for time-distance.

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[1]Edward A. Ackerman, "Where Is A Research Frontier?" Annals of the Association of American Geographers, LIII (1963), p. 437.

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The first problem in developing such a model is to empirically estimate a measure for the supply component, probably the key (or primary) component, as the demand figures for origin areas of campers in the model are available from camping permits, and the third component, distance, is readily obtained from highway maps.

The Supply Component--Camping Attraction Index

The initial step in developing a camping attraction index is selection of the elements of attraction, followed then with selection of elemental variables. The camping attraction index for Michigan State Parks is a composite of three elements:

1. The outdoor recreation activity preferences of campers.

2. A consideration of the natural resources that enhance the camping experience.

3. Facilities and services that complement the camping experience and related outdoor activities.

The available natural resources influence the types of acitvities possible; the activity opportunities are in turn conditioned by facilities and services provided. One method of visualizing the interrelationships of these three elements is construction of a flow chart such as that in Fi

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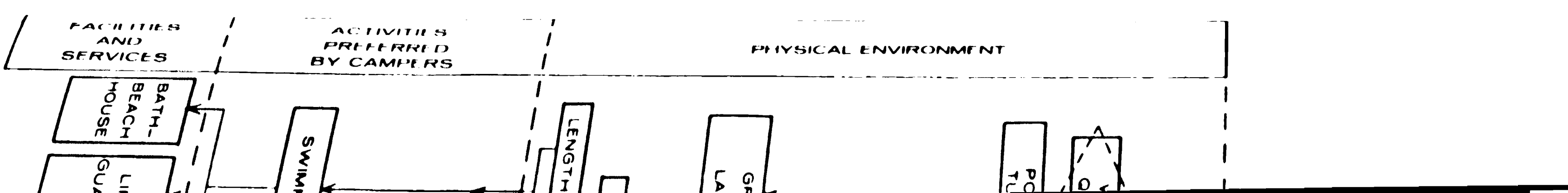
that in Figure 4. A complete inventory of these elements and their associated variables was conducted for each Michigan State Park (see Appendix D, Table 17, for the inventory sheet used). Appendixes A through C provide a more detailed discussion of each of the three elements and their variables than is included in this chapter.

Identifying Outdoor Activity Preferences of Campers

The camping attraction index for Michigan State Parks should include specific activities preferred by campers. Unfortunately, no survey or report stands out as providing the optimal data needed for the index. Several survey reports appear to be representative of the type of data necessary, but omissions of a type or types of activities, the location of interviews, differences in the phrasing of questions, and variations in the method of presenting the data make comparison difficult.

Some clarification is necessary at this point between two terms--preferences for activities as opposed to participation in activities. Preferences are the desires or aspirations for particular activities, while participation implies actually undertaking a certain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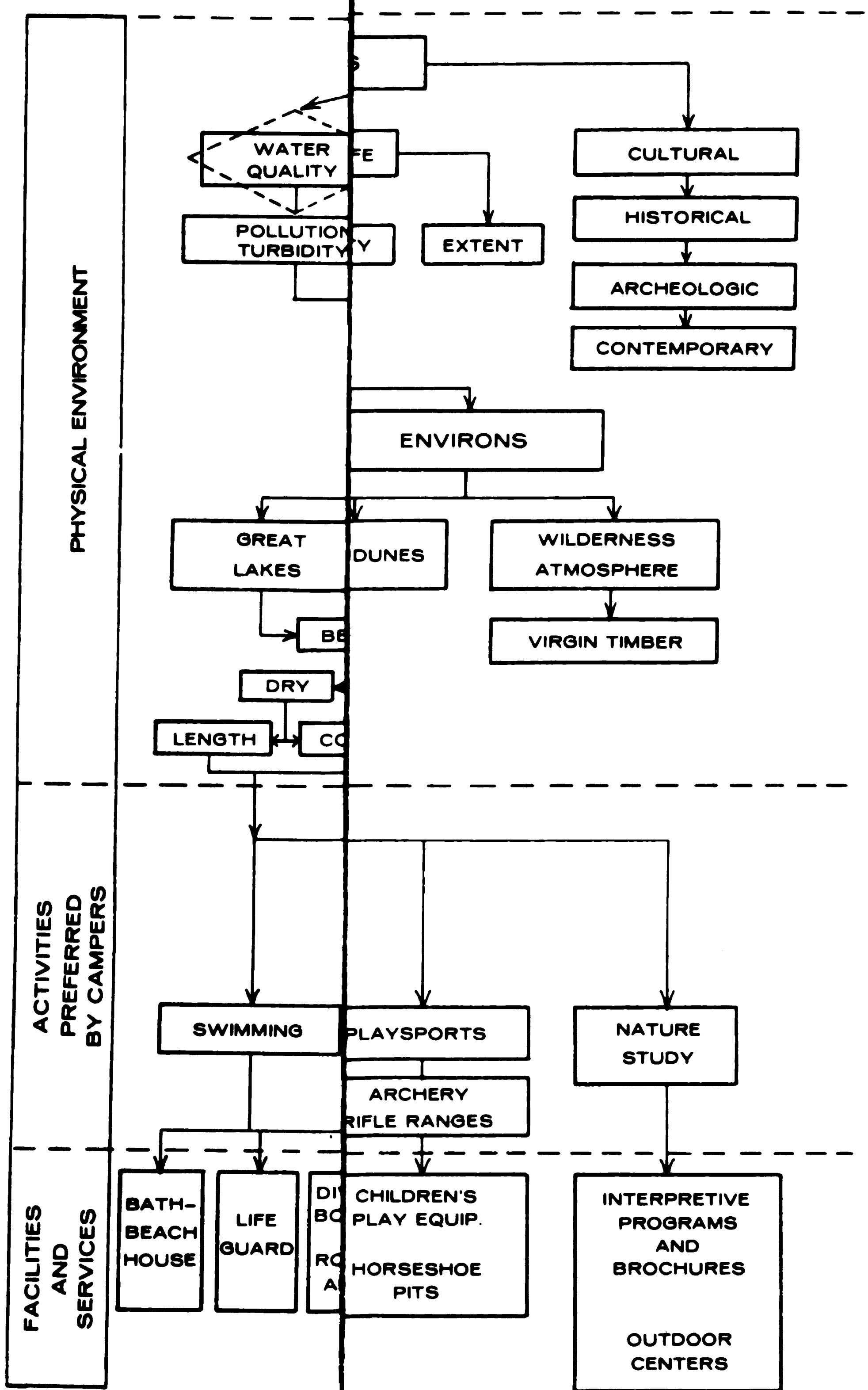
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activity at a recreation site. Since the choice of a park is based on what types of activities are perceived as being possible once there, preferences are more important for the purposes of an attraction index. While at the park, the visitor may not choose to partake of a given activity, but the possibility of participation will still exist. The National Recreation Survey agrees that "the unfulfilled demand for an outdoor recreation activity is reflected in preferences for the activity, even though the person may not participate."[2] Information on preferences for activities are therefore desirable for developing the attraction index. Since preference data is not always available, however, the selection of ratings for activities will of necessity be based on participation rates.

The National Recreation Survey provides insight into the importance of camping relative to other outdoor recreation activities (Table 1). The most important activities for the North Central Region are picnicking, sightseeing, swimming, playing outdoor games, and fishing. With few exceptions, these are the most popular activities on a national basis also. Camping participation, relative to

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[2]U.S., Outdoor Recreation Resources Review Commission, National Recreation Survey, Study Report 19 (Washington: U. S. Government Printing Office, 1962), p. 4.

TABLE 1.--
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TABLE 1.--Percent of persons 12 years and over participating in various outdoor recreation activities, United States and North Central Region, Summer, 1960

Activity	Percent of Persons Participating			
	United States		North Central Region	
	%	Rank[a]	%	Rank
Picnics	53	1	58	1
Driving for Pleasure	52	2	58	1
Swimming	45	3	42	3
Sightseeing	42	4	47	2
Walking for Pleasure	33	5	29	6
Playing Outdoor Games	30	6	35	4
Fishing	29	7	33	5
Attending Outdoor Sports Events	24	8	28	7
Other Boating	22	9	27	8
Nature Walks	14	10	15	9
Bicycling	9	11	10	10
Attending Outdoor Concerts, Drama, etc.	9	11	11	9
Camping	8	12	7	11
Hiking	6	13	5	13
Horseback Riding	6	13	5	13
Water Skiing	6	13	6	12
Miscellaneous	5	14	5	13
Hunting	3	15	2	15
Canoeing	2	16	3	14
Sailing	2	16	2	15
Mountain Climbing	1	17	1	16

[a]Ranking was done by the author.

Source: U.S., Outdoor Recreation Resources Review Commission, National Recreation Survey, Study Report 19 (Washington: U.S. Government Printing Office, 1962), Table 1.01.

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the other activities, is very low. This means that in developing the activity preferences of campers, the focus is on a small proportion of the total population participating in outdoor recreation activities.

Using the list of activities in Table 1, it is possible to specify activities that can be undertaken in Michigan State Parks and to eliminate many activities that are either impossible in the parks or are not included in a complex of choices desired by campers while in the parks. Using the participation rates for the North Central Region, the most popular activities that can be undertaken in most Michigan State Parks are picnicking, sightseeing, swimming, playing outdoor games, fishing, walking for pleasure, and boating. Activities with a much lower percentage of participation are, in decreasing order, nature walks, bicycling, camping, water skiing, horseback riding, hiking, canoeing, sailing, and hunting.

Some of these activities can be eliminated from consideration. Hunting, for example, is an important outdoor activity at some sites; it is allowed in state recreation areas, but only in a few state parks. Since hunting occurs during October to March, after the May to

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October camping season, it will not be considered further as an activity in the index.

Bicycling is limited in Michigan State Parks. A majority of the people do not bring bicycles with them, and bicycle rentals are not provided in the parks. The exception to this is Mackinac Island, which will not be considered here as a part of the Michigan State Park System.[3]

Horseback riding is done in a few parks and recreation areas adjacent to the Detroit Metropolitan Area and will be considered here as an attraction in these parks. For the most part, however, this activity will not be pertinent to the attraction index.

Driving for pleasure and attending sports events also can be eliminated. Sports events are not organized within any of the parks, and a majority of the parks are too small to offer long scenic drives within the confines of the park. Driving for pleasure may very well be important in considering the distance of parks from visitors' homes

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[3]Mackinac Island and Fort Michilimackinac are administered by the Mackinac Island State Park Commission and not the Parks Section of the Michigan Department of Conservation. These two parks have a special character in that they are primarily historical sites with many commercial establishments nearby, and, in this respect, are different from a majority of state parks.

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and the type of landscape to be traversed, but this activity will not be considered further since measurement of its magnitude is difficult without more detailed information than is now available.

Walking for pleasure and nature walks are considered as one activity in this study--hiking is considered separately. Mountain climbing is excluded since it can not be undertaken in any state park.

Although winter sports such as ice skating, skiing, and sledding are not included in Table 1, they are important activities in Michigan. They are not included as elements of the attraction index because they do not occur in the summer season when the majority of camping takes place.

Two national surveys in the ORRRC Reports provide national and regional activity-participation rates for campers. The first compares activity-participation rates between campers and non-campers in a number of outdoor activities. This data is shown in Table 2, reproduced from ORRRC Report 20.[4] The information in this table

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[4]U.S., Outdoor Recreation Resources Review Commission, Participation in Outdoor Recreation: Factors Affecting Demand Among American Adults, Study Report 20 (Washington: U. S. Government Printing Office, 1962), p. 68.

TABLE 2.--Comparison of participation in other outdoor activities by campers and non-campers[a]

Per Cent Participation Among Those Who Went Camping

TABLE 2.--Comparison of participation in other outdoor activities by campers and non-campers[a]

Activity	Often	1-4 Times	Total Often and 1-4 Times	Not at All	Total
	Per Cent Participation Among Those Who Went Camping				
Outdoor Swimming or Going to a Beach					
Campers	43	25	68	31	100
Non-campers	25	20		54	100
Boating and Canoeing					
Campers	31	26	57	42	100
Non-campers	9	15		75	100
Fishing					
Campers	46	28	74	25	100
Non-campers	17	17		62	100
Hiking					
Campers	22	25	47	51	100
Non-campers	5	9		84	100
Nature and Bird Walks					
Campers	13	14	27	72	100
Non-campers	5	8		86	100

TABLE 2.--Cont'd.

	Percent Participation Among Those Who Went Camping
	Total

TABLE 2.--Cont'd.

Activity	Percent Participation Among Those Who Went Camping				
	Often	1-4 Times	Total Often and 1-4 Times	Not at All	Total
Picnics					
Campers	59	32	91	9	100
Non-campers	29	37		33	100
Horseback Riding					
Campers	8	8	16	83	100
Non-campers	2	3		94	100

[a]Hunting, skiing, other winter sports, automobile sightseeing, and relaxation were included in the original table. They are omitted here because they are not included in the attraction index.

Source: U.S., Outdoor Recreation Resources Review Commission, Participation in Outdoor Recreation: Factors Affecting Demand Among American Adults, Study Report 20 (Washington: U. S. Government Printing Office, 1962), p. 68.

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was obtained by a home interview survey and not from campers actively undertaking a camping trip. People not particularly interested in outdoor recreation--persons fifty-five years of age and over, and people with incomes under $3,000--were excluded from the original table. The data in this table are relevant, however, because it is the only data found that compares activity-participation between those preferring camping and those not. This table indicates that campers are more active in many outdoor activities than non-campers. Three-fourths of the campers go fishing, two-thirds go swimming, and more than one-half go boating. Campers also prefer hiking, nature walks, and horseback riding. The willingness of a camper to "rough it" also appears in the camper's desire for picnics which is higher than for non-campers.

By combining the percentages for campers in the first and second columns of Table 2, an estimate of the importance of each of the activities to an active camper is readily obtained (column three). For instance, picnics are the most popular activity of campers, with 91 per cent, followed by fishing with 74 per cent, swimming 68 per cent, boating and canoeing 57 per cent, hiking 47 per cent, nature an

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nature and bird walks 27 per cent, and horseback riding 16 per cent. These figures provide an estimate of the combination of activities that might be considered desirable for the "average camper," ranked in order of preference.

Similar activity desires of campers are indicated in the National Recreation Survey. This survey, like ORRRC Report 20, attempts to identify participation patterns according to the socio-economic characteristics of persons undertaking outdoor activities. Persons are hypothesized to have activity preferences that can be predicted.

> For example, it is expected that an individual who frequently fishes will have an affinity for other water-related activities. Similarly a person who frequently participates in such activities as sightseeing, driving for pleasure, and attending outdoor events is expected to have an affinity for related urban-centered outdoor activities.[5]

The correlation coefficients from the National Recreation Survey allow a more detailed comparison of camping with the other activities. Camping is strongly associated with water activities such as fishing, swimming, and boating (Table 3). The strong association of camping with hiking is not surprising since hiking was

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[5]ORRRC Report 19, op. cit., p. 6.

TABLE 3.--

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TABLE 3.--Correlation coefficients of participation in selected activities with camping participation, Summer, 1960

Activity	Correlation Coefficient
Hiking	0.28
Boating	.22
Fishing	.21
Swimming	.21
Water Skiing	.21
Horseback Riding	.09
Attending Outdoor Sports Events	.08
Walking for Pleasure	.06

Source: U. S., Outdoor Recreation Resources Review Commission, National Recreation Survey, Study Report 19 (Washington: U. S. Government Printing Office, 1962), p. 33.

defined in the report as being "along a trail with a pack,"[6] suggesting an outing requiring an overnight stay. In this survey camping and hiking were treated as "backwoods" activities. For example, campers were asked if they had camped in "developed" or "in wilderness or remote areas."[7] Sixty-five per cent of the campers had patronized "developed" rather than "wilderness" campsites. This

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[6] Ibid., p. 108.

[7] Wilderness areas or undeveloped areas were defined as "an area not accessible by improved roads and without developed campsites." Sites of this type would be accessible only by "packing in." Ibid., p. 33.

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would indicate that the "backwoods" connotation attached to camping may not be strong in spite of the high correlation between camping and hiking in the national survey.

Since most of the campgrounds in the Michigan State Parks are developed rather than undeveloped, and since there are few parks large enough for wilderness hiking to a remote campsite, the relationship between hiking and camping of this type is not significant. With the importance of hiking minimized, the similarity between ranking of the correlation coefficients in Table 3 and the percentage ranking of preferred activities listed in Table 2 is apparent.

The two national surveys, ORRRC Reports 19 and 20, provide the best information on the activity preferences of campers. An analysis of several state and local surveys--two Michigan State Park surveys,[8] a Wisconsin State Park

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[8]Thomas L. Dahle, Michigan State Park Users Survey, Bureau of Business Research, College of Business and Public Service, Research Report No. 19 (Michigan State University, East Lansing, Mich., 1956), and Michigan House of Representatives, Report of Committee on State Parks and Public Lands (Lansing, 1962). The last reference is widely known as the Van Til Report after the Committee Chairman, Representative Reimer Van Til, References in the text will be to the Van Til Report.

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survey,[9] and a study of camping parks in Iron County, Michigan,[10]--is in reasonably close agreement with preferences found in the national surveys.[11] However, there are obvious informational gaps in the state and local surveys (see Appendix A for a detailed discussion of the state and local surveys). The first Michigan State Park survey by Dahle may be outdated and, in any event, is too general, with no breakdown of camper activity preferences. The Van Til Report, the second Michigan State Park survey, is also limited in terms of a discussion of camper activities. Camper activities are discussed in more detail in the Gilbert Study, but it is restricted to a few localized

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[9]H. Clifton Hutchins and Edgar W. Trecker, Jr., The State Park Visitor--A Report of the Wisconsin Park and Forest Travel Study, Wisconsin Conservation Department, Technical Bulletin No. 22 (Madison, Wisc., 1961).

[10]Alphonse H. Gilbert, "A Survey of Vacation Camping in Iron County, Michigan" (unpublished Master's thesis, Department of Resource Development, Michigan State University, 1963).

[11]There are many other surveys of the use of state parks available. However, they were not included in the discussion primarily because the states were remote from Michigan. One example was Washington State Parks and Recreation Commission, We Come to Camp in Washington State Parks--Overnight Camping Survey (Olympia, Wash., 1956). An additional survey has recently been called to the author's attention. This survey is Ohio Department of Natural Resources, Ohio State Parks--Travel and Use Survey (Columbus, Ohio: Division of Parks and Recreation, 1963).

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parks. In spite of the lack of data directly applicable to the entire Michigan system, the attempt will be made to estimate numerical preference values for activities undertaken by campers.

Rating Scales Based on Activity Preferences

To numerically rate the preferences for outdoor activities, attributes of the physical resources, and facilities and services, a judgment rating scale is necessary. The judgment for activity preference is made on the basis of an average preference for each activity according to the studies reviewed.

The type of rating scales used throughout the development of the attraction index are reasonably well-established in the fields of sociology and psychology.[12] The rating scales (1) order or categorize a variable and (2) assign an interval scale to the ordered categories. Both involve judgments. Professionals may not agree, for example, on what is a proper classification of vegetative types, or which types are of a higher quality for

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[12]For examples see Warren S. Torgerson, Methods of Scaling (New York: John Wiley & Sons, 1958); William J. Goods and Paul K. Hatt, Methods in Social Research (New York: McGraw-Hill Book Co., 1952), and Matilda White Riley, John W. Riley, Jr., and Jackson Toby, Sociological Studies in Scale Analysis (New Brunswick, N.J.: Rutgers University Press, 1954).

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The procedure used for scaling is explicit. Anyone who disagrees with any particular scaling can see exactly what has been measured, and precisely where to insert whatever alternative measure may be preferred. The final test of the validity of the procedure is its workability. This is tested in the interaction model.

Four water-based activities have repeatedly been mentioned in the literature reviewed: swimming, fishing, boating,[13] and water skiing. In ORRRC Report 20, which compared participation rates of campers and non-campers, the highest participation rate was for fishing, followed by swimming and boating. Water skiing was not included (Table 2). The National Recreation Survey listed North Central Region participation rates for these activities as follows: fishing 33 per cent, swimming 42 per cent,

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[13]Boating includes canoeing and sailing. Limited data is available on canoeing and sailing and most reports combine them with boating.

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boating 27 per cent, and water skiing 6 per cent (Table 1). The Dahle Survey, like the National Recreation Survey, indicates that swimming is more popular than fishing, and boating is the least popular (see Appendix A). The correlation coefficients from the National Recreation Survey (Table 3) are of some help, since they indicate the relative association of these water activities with camping. The Van Til Report states that swimming was the activity most preferred by all park users. It also states that a "majority of campers do not require boating as part of their recreation."[14] On the basis of this summary, swimming will be given the most weight, followed by fishing, boating and water skiing.

Subjective values assigned to these activities must be varied for each park, depending upon the type of water body adjacent to or within the park. In some parks located on the Great Lakes and on inland lakes, swimming can be undertaken in both. In these cases a value for swimming as an activity is applied for swimming in the Great Lakes, and an additional value derived for swimming in an inland lake. Since Great Lakes swimming usually

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[14]Report of Committee on State Parks and Public Lands, op. cit., p. 11.

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involves relatively cooler water, more currents, and frequent lack of diving platforms or roped areas, inland lake swimming is assigned a higher value.

In a similar manner, fishing is given a lower weight on the Great Lakes and on rivers than on inland lakes. Boating is given a higher weight on inland lakes than on rivers, where boating capacity and maneuverability are limited. Michigan State Parks have no boat launching sites on the Great Lakes, therefore no weight is given for boating on the Great Lakes. Weights assigned to each of these four activities are listed below.

	Inland Lakes	Great Lakes	Rivers
Swimming	20	16	--
Fishing	16	9	9
Boating	8	---	4
Water Skiing	6	---	--

Preferences for land activities--hiking and nature walks, horseback riding, and play sports--are assigned numerical values in a manner similar to that used for water activities. An examination of the previous tables indicates that both preference and participation weights for hiking frequently are equal to those for boating (Tables 2 and 3). In a few instances, a combination of hiking, walking for pleasure, and nature and bird walks results in

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results in a higher preference than that for boating. In one instance hiking is as low as the preference for water skiing (Table 1); however, since many Michigan State Parks are of ample size for hiking and have well-marked trails (some with nature brochures), hiking is assigned a weight of 7. This places it above water skiing, lower than boating.

Preferences for horseback riding are not listed in many statewide surveys and this activity is not particularly important in Michigan State Parks. In the few where it is available, it is given a token weight of 4 to increase the park's attractiveness.

Because play equipment--swings, teeters, and slides--appears to be important to family campers, it is given a weight of 3.

Several parks contain archery and rifle ranges. These activities are not included in any of the reports reviewed, but the availability of facilities of this type can be an attraction. Therefore, each of these activities is given a weight of 1.0. A summary of the weights for land activities is listed below.

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Hiking - Nature Walks	7
Horseback Riding	2
Children's Play Equipment	2
Rifle - Archery Range	1

Several land activities have been eliminated. Picnicking, although an important activity, has not been considered directly. It is primarily a day-use activity inherent in any camping experience. Camping, likewise, has not been given a weight, since this activity is the primary focus of the attraction index. Sightseeing, a highly preferred activity, is difficult to measure and is only partially included elsewhere as part of the index.

Table 4 lists the activity weights assigned to each of the fifty-nine parks in which family camping is permitted. These activity weights are summed by rows for each park and then standardized with a mean of 0.0 and a standard deviation of 1.0. The weights are arbitrary and admittedly allow for improvement, but they are based on the best surveys available, and it is believed that they do express general activity preferences for a majority of the camping populace.

Eleven of the fifty-nine Michigan State Parks have activity rating scores of 1.00 or higher. Five of these recreation sites are state recreation areas in southern

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Michigan State Park or Recreation Area	Great Lakes - Swimming 1
ALGONAC	
ALOHA	
BALD MOUNTAIN	
BARAGA	16
BAY CITY	16
BENZIE	
BRIGHTON	
BRIMLEY	16
BURT LAKE	
CHEBOYGAN	16

TABLE 4

NUMERICAL ACTIVITY WEIGHTS BY WATER AND LAND ACTIVITIES ASSIGNED TO MICHIGAN STATE PARKS

Michigan State Park or Recreation Area	Great Lakes - Swimming 1	Great Lakes - Fishing 2	Inland Lakes - Swimming 3	Inland Lakes - Fishing 4	Inland Lakes - Boating 5	Inland Lakes - Waterskiing 6	Rivers - Fishing 7	Rivers - Boating - Canoeing 8	Hiking 9	Play Equipment 10	Rifle - Archery 11	Horseback Riding 12	Total Score 13	Standard Score 14
ALGONAC							9	4	7	2	1		23	- .98
ALOHA			20	16	8	6				2			52	+ .49
BALD MOUNTAIN				16			9						25	- .83
BARAGA	16	9			8		9			2			44	+ .10
BAY CITY	16				8					2			26	- .78
BENZIE							9	4	7	2			22	- .98
BRIGHTON			20	16	8	6	9		7				66	+1.18
BRIMLEY	16								7	2			25	- .83
BURT LAKE			20	16	8	6	9	4		2			65	+1.13
CHEBOYGAN	16				8								24	- .88

TABLE 4.--Contd.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
D. H. DAY	16								7				23	- .93
DODGE BROS. No. 4[a]			20	16	8	6							50	+ .39
EAST TAWAS	16	9			8								33	- .44
FAYETTE	16				8								24	- .88
FORT CUS-TER[a]											1		1	-2.00
FORT WILKINS				16	8				7				31	- .54
GLADWIN							9			2			11	-1.52
GOGEBIC LAKE			20	16	8	6			7	2			59	+ .83
GRAND HAVEN	16	9					9						34	- .39
HARRISVILLE	16				8				7				31	- .54
HARTWICK PINES					8		9		7	2			26	- .78
WALTER J. HAYES			20	16	8	6				2			52	+ .49
HIGGINS LAKE			20	16	8	6			7	2			59	+ .83
HIGHLAND			20	16	8	6			7	2		2	61	+ .93
P. H. HOEFT	16				8		9		7	2			42	.00
HOLLAND	16	9		16						2			43	+ .05

TABLE 4.--Contd.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
HOLLY			20	16	8	6	9		7	2			68	+1.27
INDIAN LAKE			20	16	8	6	9		7				66	+1.17
INTERLOCHEN			20	16	8	6				2			52	+ .49
ISLAND LAKE			20	16	8	6	9	4	7				70	+1.37
LAKEPORT	16				8								24	- .88
LUDINGTON	16		20	16	8	6	9		7	2			84	+2.06
F. J. MC LAIN	16									2			18	-1.18
CHARLES MEARS	16	9								2			27	- .73
METAMORA-HEADLEY			20	16	8								44	+ .10
WM. MITCHELL			20	16	8	6				2			52	+ .49
MUSKALLONGE LAKE			20	16	8	6							50	+ .39
MUSKEGON	16	9		16	8	6			7	2			64	+1.08
ONAWAY			20	16	8	6			7	2			59	+ .83
ORCHARD BEACH	16									2			18	-1.18
ORTONVILLE			20	16	8	6			7	2		2	61	+ .93
OTSEGO LAKE			20	16	8	6				2			52	+ .49
PINCKNEY			20	16	8	6	9		7	2		2	70	+1.37

TABLE 4.--Contd.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PONTIAC LAKE			20	16	8	6	9		7	2	1	2	71	+1.42
PORCUPINE MTS.	16	9		16	8		9	4	7				69	+1.32
PORT CRESCENT	16				8		9			2			35	- .34
PROUD LAKE			20	16	8	6	9	4	7	2			72	+1.47
ROCHESTER-UTICA							9		7		1		17	-1.22
SILVER LAKE			20	16	8	6				2			52	+ .49
SLEEPER	16				8				7	2			33	- .44
STERLING-MONROE[a]					8					2			10	-1.57
STRAITS					8					2			10	-1.57
TAHQUAMENON	16						9	4	7				36	- .29
TRAVERSE CITY	16				8					2			26	- .78
VAN RIPER			20	16	8	6	9	4	7	2			72	+1.47
WARREN DUNES	16						9			2			27	- .63
WATERLOO			20	16	8	6	9		7	2			68	+1.27
J.W. WELLS	16						9	4	7	2	1		39	- .15
WHITE CLOUD							9						9	-1.62

TABLE 4.--Contd.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
WILDERNESS	16				8		9		7				40	- .10
WILSON			20	16	8	6				2			52	+ .49
YANKEE SPRINGS			20	16	8	6			7				57	+ .73
YOUNG			20	16	8	6							50	+ .39
NUMBER OF PARKS RE-CEIVING WEIGHT	25	7	28	33	46	28	27	9	31	41	5	4		

[a]Camping not permitted.

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Michigan--Brighton, Holly, Island Lake, Proud Lake, and Waterloo. With the exception of Waterloo, all are easily accessible for visitors from the Detroit Metropolitan Area. Two of the eleven parks are located in west central Michigan on Lake Michigan. These are Ludington and Muskegon State Parks. Both of these parks have lands accessible to inland lakes as well as the Great Lakes. The remaining four parks with high activity-rating scores are Burt Lake in the lower Peninsula and Indian Lake, Porcupine Mountains and Van Riper in the Upper Peninsula.

Six of the fifty-nine parks have activity scores of less than 1.00. These are Gladwin, McLain, Orchard Beach, Rochester-Utica, Straits, and White Cloud. All of these parks are adjacent to a water resource, either the Great Lakes, inland lake, or river, but in all cases the natural resources are not of sufficient quality or have not been developed to permit active water-based activities. A more detailed appraisal of the natural resources is included in the next section of this chapter.

Identifying Natural Recreation Resources

A second major factor to be considered for the index of camping attraction is the natural environmental factor.

Natural-cultural features are of principal significance to campers in Michigan State Parks. There are problems, however, in measuring the way the physical environment in a park is perceived and valued, rationally or irrationally, for outdoor recreation purposes. The ultimate objective is to relate the outdoor activities preferred by campers to the physical environmental attributes necessary for each activity.

Experience Approaches

Evaluation of a landscape for a specific outdoor recreational activity such as swimming can involve some tangible attributes. The length of a beach or the quality of a beach surface can be measured and expressed in swimming opportunities that could be provided. However, appraisal of a park's total landscape in terms of its scenic qualities and aesthetic appeal involves individual human emotions and elusive intangible values.

One method for measuring qualities of the physical environment is by user satisfactions or dissatisfactions of the outdoor experience.

> It is apparent from the results of this study that users' remarks about area quality are strictly relative and reflect personal judgments. Expressions of user satisfaction do not necessarily

> measure the "quality" of an area, but instead the enjoyment of the visitor, based on a multiplicity of factors impinging on his specific visit. This satisfaction is based on personal desires and preconceived ideas about the area, the activities available, and the facilities provided to assist in the enjoyment of these activities, as well as the natural setting and the kind of maintenance the area receives.[15]

A survey of the type undertaken in ORRRC Report 5 could not be done for this study. However, a future survey of user opinions could use the results of the index developed here for comparison and analysis.

Without a user survey, one can approach the tangible and intangible values or qualities of a recreational landscape by considering the many facets of recreational experience. The National Advisory Council of Regional Recreation Planning (NACRRP) in A User - Resource Recreation Planning Method suggests six values that may be used individually or in combination to measure the outdoor recreational experience: physical, emotional, aesthetic, educational, social, and intellectual experiences.[16]

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[15]U. S., Outdoor Recreation Resources Review Commission, The Quality of Outdoor Recreation: As Evidenced by User Satisfaction, Study Report 5 (Washington: U. S. Government Printing Office, 1962), p. 43.

[16]National Advisory Council on Regional Recreation Planning, A User - Resource Recreation Planning Method (Hidden Valley, Loomis, Calif., 1959), p. 27.

The physical experience is probably the easiest of the six recreational experiences to recognize and measure since it entails actual participation and commitment by the individual. This value is tangible; the recreational landscape requirements for a variety of outdoor activities can be identified and quality and resulting use of these resources measured or approximated.

The values of the remaining five recreational experiences are much more difficult to identify[17] because they constitute the intangibles of the recreational experience. Depending to some extent on the quality of the physical environment, the five, particularly the

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[17]The emotional experience, in a sense, is directly related to the physical experience and can be identified by physical reaction in activity situations such as the exaltation experienced after scaling a mountain peak. Aesthetic experiences are the most intangible and much more difficult to isolate. A mental response is necessary to appreciate the flatness of the plains, the depth of a mountain canyon, or the solitude of an alpine lake. Each person views these landscapes differently. Educational and intellectual experiences in relation to recreation are just beginning to be recognized in our "cultural revolution." Social experiences are more easily measured by planning the use of natural resources to provide a variety of situations to encourage the social experience; however, this involves major problems of design and land-use planning. Some campers relish the social contact with neighbors in a campground, while others desire the solitude provided by a wilderness tract.

emotional and aesthetic experience, involve the complexities of human personality.

Investigations into these two experiences by social scientists are scarce;[18] however, the need for studies of this type is recognized[19] and ORRRC Report 5[20] is close to being an investigation of this type. The results of one continuing study on wilderness perception and use recently published[21] deals with the Boundary Waters Canoe Area in Minnesota. It is not directly applicable to this analysis but the research method is a good one and is preferable to the approach that has been feasible here. The method involved an investigation of the users' perceptions of the wilderness environment and the outdoor activity uses taking place. In the

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[18]As this study was completed, another study worthy of mention was concluded. Among other analyses, it involves a discussion of the recognition of users' images of a satisfying experience within a recreation landscape. Unfortunately it was completed too late to be incorporated into the discussion above. The study is Clare A. Gunn, A Concept for the Design of A Tourism -- Recreation Region (Mason, Mich.: The B. J. Press, 1965).

[19]Ibid., p. 53.

[20]ORRRC Report 5, op. cit., p. 43.

[21]Robert C. Lucas, "Wilderness Perception and Use: The Example of the Boundary Waters Canoe Area," Natural Resources Journal, III (January, 1964), p. 394.

present analysis, the outdoor recreation activity experiences desired by campers are matched with the estimated ability of the natural environment to provide the resources necessary for these activities.

Resource Approaches

What physical attributes of a park influence individual preference for one kind of landscape over another for various outdoor recreation activities? One of the earliest professional discussions of park attributes was a 1937 article[22] in which six types of park "appeal" were listed and briefly discussed. They are (1) aesthetic appeal to sight, sound, touch, and smell; (2) the curious and unusual, such as mineral springs and caves; (3) scientific interest of a geological or ecological nature; (4) primitive appeal-wilderness concept; (5) historic, and (6) utilitarian appeal, or outdoor-activity centered. These attributes of a park are still applicable today, but several more recent listings combine the attributes differently. Basically the attributes are sub-divided in terms of natural and cultural features of the landscape.

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[22] S. F. Brewster, "Park Appeal," Planning and Civic Comment (October-December, 1937), p. 38.

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Baker lists the following as major environmental factors for recreational land use:[23]

I. Cultural environmental factors

A) Location in relation to population

B) Historic association

II. Natural environmental factors

A) Physiographic pattern

(1) Water access and shoreline conditions

(2) Topographic configuration

(3) Drainage conditions

B) Vegetative pattern

(1) Composition or type

(2) Form - nature, crown cover, etc.

C) Biologic pattern

(1) Bird and animal population

(2) Fishing conditions

D) Climatic pattern

(1) Temperature

(2) Wind

(3) Precipitation

(4) Amount of sunshine, fog, etc.

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[23]W. M. Baker, "Assessing and Allocating Renewable Resources for Recreation," in <u>Resources for Tomorrow: A Report to the Department of Northern Affairs and National Resources</u> (Montreal, October 23-29, 1961), p. 998.

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The literature contains many examples of a general or specific nature that are similar to the above classifications.[24]

Combined Approaches

Several persons have gone a step further in relation to the physical environment by attempting to classify and rate the quality of natural features relative to activity preferences of the users. ORRRC Report 5 classified twenty-four recreation sites in the nation in three ways: (1) by administrative agency, (2) by major activity attraction (this was done for Michigan Parks in the previous section), and (3) by type of physical resources.[25] The bio-physical character of sites were evaluated according to topographic relief--flat, rolling, hilly, or mountainous; water resources--contiguous to water bodies, rivers or streams, or absence of water, and by vegetation--whether barren, pastoral, or forested.

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[24]Some examples are Robert D. Campbell, The Geography of Recreation in the United States (unpublished Ph.D. dissertation, Department of Geography, Clark University, 1949), p. 30; C. Frank Brockman, Recreational Use of Wild Lands (New York: McGraw-Hill Book Co., 1959), pp. 113-127; and Phillip H. Lewis, Jr., Recreation and Open Space in Illinois (Urbana: Division of Landscape Architecture and the Bureau of Community Planning, University of Illinois, 1961), p. 9.

[25]ORRRC Report 5, op. cit., p. 13.

In the Meramac Basin Research Project, Ullman, Boyce, and Volk discuss the physical quality of reservoirs relative to their use for specific recreational activities.[26] Their six factors are sub-divided for purposes of judging a site or area.

	Major Factors	Sub-Components
I.	Appearance and character of the shoreline	Landform--slope and relief Soil and bedrock--beach type Vegetation--type of trees and extent of cover Cultural features
II.	Physical characteristics of the lake	Size Shape Fluctuation in water level Depth of water
III.	Water quality	Turbidity Pollution Temperature
IV.	Fishing quality	
V.	Climate	
VI.	Accessibility	

Included in their study is a discussion of the physical factors on outdoor recreation activities at reservoirs.

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[26]Edward L. Ullman, Ronald R. Boyce, and Donald J. Volk, The Meramac Basin - Water and Economic Development, Vol. III: Water Needs and Problems (St. Louis, Mo.: Meramac Basin Research Project, Washington University, December, 1961), Chapter V, p. 42.

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Portions of the ensuing analysis draw upon this report for appraisal of physical qualities in Michigan State Parks.

Rating the Qualities of the Recreation Environment

Both of the before mentioned studies attempted to rate the physical qualities of the recreation landscape. These ratings were of a subjective, generalized nature.

None of the studies reviewed have attempted to rate or scale the qualities of physical environment in order to combine thses scores into an overall rating or index of attractiveness. In this study actual interval scales will be used to measure some environmental elements. Other variables have binary values, i.e., 0.00 if a physical variable is absent, and 1.00 if it is present in a park. A measure of this type is crude, but until other means are devised for scaling these variables, binary values are necessary.

To analyze each physical attribute relative to the outdoor activities and to select a numerical value that reflects its quality for activities requires a step by step inventory and evaluation. Several inventory evaluation schedules from national agencies and commissions have bee

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have been studied to construct the inventory sheet (Appendix D, Table 17) and to obtain insights into numerical scales that have been used.[27] The inventory sheet records as many variables as possible for each park. Appendix D, Table 18, contains a complete listing of the variables inventoried, type of scale used, numerical range of variables, and source of information. Not all the variables inventoried and initially measured were used in the final index of attraction. Some, when tried in the index, proved not to be particularly strong causative variables.

Below is an outline of the variables in the natural environment considered important in the camping experience and in outdoor activities desired by campers. Each variable was analyzed for its significance in undertaking outdoor recreational activities and then classified for use in the aggregate index. See Appendix B for a detailed

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[27]For examples see ORRRC Report No. 5, op. cit., pp. 52-58; U. S., Bureau of Outdoor Recreation, Inventory, Classification, and Evaluation of Existing Outdoor Recreation Areas and Facilities, Form B.O.R. 8-73 (Washington, D.C.: Department of the Interior, 1965); U. S., Bureau of Land Management, Recreation Site Inventory and Evaluation, Form 4-1644 (Washington, D.C.: Department of the Interior, June, 1963); U. S., Forest Service, Work Plan for the National Forest Recreation Survey - A Review of the Outdoor Recreation Resources of the National Forests (Washington, D.C.: Department of Agriculture, August, 1959), mimeographed.

discussion of each element and the judgment rating selected.

I. Terrain - Slope, local relief, landform types - falls, cliffs, springs, sand dunes

II. Size of park

III. Vegetation - Evergreen, mixed evergreen and deciduous, deciduous, barren, extent of virgin timber and wilderness characteristics, amount of shade in the campground

IV. Wildlife

V. Climate - Average daily air temperature in July

VI. Water resources - Size of water body (including interlake connections), average daily water temperature in July, frontage of inland and Great Lakes shorelines, frontage on rivers and streams, water quality - amount of pollution, fishing quality and success

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VII. Beach characteristics - Length and width of dry beach, composition of dry and wet beach, extent of dropoff for wet beach

VIII. Cultural features - Historic and archaeologic, contemporary (Straits of Mackinac Bridge, shipping on Great Lakes)

Identifying Facilities and Services

Outdoor activities undertaken by campers are also influenced by the facilities and services available at a park. A discriminating camping populace will seek out parks that offer facilities, services, and environments which will hopefully fulfill their camping expectations. Certain basic facilities and services have been demanded and are currently expected to be available in any Michigan State Park. Some of these demands for services and facilities are necessary for reasons of sanitation. Others are necessary in order that certain outdoor activity desires can be met. A select few such as showers are obviously assets in the camping experience. The basic facilities and services must be included as an essent

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essential part of the attraction index, while a few of those that could be considered assets also are included.

Facilities and services have been interpreted in more than one way. ORRRC Report 20 discusses facilities in terms of recreational sites or entities which may or may not include an entire park or forest area.[28] A similar definition of facilities is implied in the statement of Perloff and Wingo.[29] Essentially, these definitions refer to the availability of a physical area within which outdoor activities can be undertaken. This also includes man-made structures or modifications of natural resources which are necessary for some activities as well as services that may or may not be amenities for daily living.

For purposes of this study, however, facilities are not defined as the entire park, but as the structures and physical improvements within the park. Services can be defined in terms of utilities such as toilets or water supply and in terms of concession operations such as camp stores and boat rentals. In addition, services can be recognized as the collection of refuse or the

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[28]ORRRC Report 20, op. cit., p. 7.

[29]Perloff and Wingo, op. cit., p. 89.

availability of a naturalist. Viewed in this manner, it is obvious that the quality of facilities and services is an important aspect of the camping experience.

To a limited number of campers, those who like to "rough it," the presence of too many facilities and services are undesirable. The demands of these campers tend to be satisfied better in the less-developed state and national forests of Michigan. It should be re-emphasized that the index of camping attraction developed for this study is intended to reflect the present conditions applicable to a majority of campers in Michigan State Parks.

What facilities and services are preferred by campers in Michigan State Parks and should be included in a measure of a park's camping attraction? ORRRC Report 5 contains a list of such facilities and services, including a discussion of user opinions of these facilities and services at twenty-four recreation areas in the nation.[30] The respondents in this report were asked to indicate satisfaction or dissatisfaction with the following:

1. Water Supply
2. Campgrounds
3. Parking
4. Marked Nature Trails
5. Concession Stands
6. Signs and Information Trails

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[30] ORRRC Report 5, <u>op. cit.</u>, p. 38.

7. Rental Facilities
8. Toilets
9. Boat Docks and Ramps
10. Roads
11. Tours and Organized Groups
12. Other (Write in Comments)

This survey was not limited to the camping population, but included day users, consequently the preferences of campers are difficult to isolate. The listing, however, provides an excellent starting point for evaluation of facilities and services according to user opinions. All eleven of the above facilities and services were carefully evaluated for use in the camping attraction index, but only campground characteristics, marked nature trails, concessions, rental facilities, and boat dock and ramps are actually included in the index. Explanations of the omissions are noted in Appendix C.

The Demand Component--Origin Areas of Campers

For the second component, origin areas of campers, or P, two sets of data are used. The first is an empirical estimate of the propensity of the populace in each origin area to go camping. It is based on the participation rates for camping as listed in the National Recreation Survey.[31] This estimate of P for each county

[31] ORRRC Report 19, op. cit., p. 126.

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is explained in Chapter V where it is utilized in the model. In final tests of the model in Chapter V, the estimates are replaced by a second set of data, the actual 1964 values of P for each origin area. This set of data is obtained from camping permits and is listed in Appendix D, Table 19.

The Distance Component--Travel Time between Parks and Origins

In addition to the internal attractiveness of parks, a camper's selection is dependent upon the spatial arrangement of parks. State parks, like shopping centers or individual retail establishments compete with each other for campers. Clawson has characterized the relationships between parks very well when he states:

> . . . all recreation areas or resources are in varying degrees substitutes for one another, and attendance characteristics at one area are conditioned by the existence and characteristics at others. If the different resources or areas are highly similar, each area is then almost completely competitive with each other area. If one had water recreation and another did not, it might be argued that people would go to each park independently of the others. In practice the situation is almost always somewhere between these extremes. That is, it is probable that all areas accessible to a given population are to some extent competitors or rivals, but also to some extent are independent of one another. The degree of substitutability or

> competition between areas will in large part depend on the inherent attraction of the area and its location.[32]

In the travel model it is assumed that the magnitude of the camping attraction index for each park will, when combined with the distance component, provide the competitive and/or substitutability criterion for the interaction model.

The distance between the origin base of campers and parks can be a factor that determines a camper's choice of one park as opposed to another. Distance, like the attraction of a park then, is a function that describes the propensity of the camper to travel to various parks. Such a function can be expressed in physical units, monetary units, or temporal units. The third component used as a function of distance is "over the road" travel time, or time-distance.[33] Research results of similar

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[32]Clawson and Knetsch, op. cit., p. 258.

[33]"The concept of time-distance is defined as the time required to travel a specified distance. When a certain location is said to be '. . . ten minutes from downtown', the emphasis is on time rather than on distance. To many people, especially in larger urban areas, a point to point orientation in terms of time is more meaningful than distance orientation, and the question 'How much time will it take to reach my destination' is of greater concern than "How many miles is it to my destination?' In fact, the spatial arrangement of shopping patterns and visits to alternative locations

models of this type tend to verify driving times as the best distance measures.[34] Intuitively, travel time appears to be the best measure. For many vacation campers, time is at a premium because vacation time is limited. Campers can be expected to select parks not only on the basis of their attractive qualities but on the basis of travel time to a selected park.

A map showing major highways and mileages between Michigan State Parks and county population centers was available from the Michigan Outdoor Recreation Demand Study (MORDS).[35] The population centers and parks are

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are usually decisions which are all based on an attempt to minimize ones total travel time. However, a minimization of the total travel time between two points does not necessarily minimize the total distance traveled. In order to determine a minimum travel time, one must consider variations in traffic congestion, quality of the highway or street surface, legal speed limits, and other impediments to traffic movement." Donald A. Blome, A Map Transformation of the Time-Distance Relationships in the Lansing Tri-County Area (Institute for Community Development and Services, Michigan State University), 1963, p. 1.

[34]U. S., Department of Commerce, Calibrating and Testing a Gravity Model with a Small Computer, Bureau of Public Roads, Office of Planning (Washington: U. S. Government Printing Office), 1963, p. II-7.

[35]This map was compiled by Jack Ellis and C. E. Tiedemann of the MORDS staff. Major routes were selected by inspection of the 1963 Highway Traffic Flow Map published by the Michigan Department of Highways. Highways with fewer than 300 vehicles were omitted, unless necessary for a park-origin connection.

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connected by the most direct routes. Using the mileage map and estimated driving times for each link (county nodes and state parks or highway intersections), the author calculated the travel time for this study and for MORDS (see Figure 5).[36] There are eighty-eight origins--seventy-one Michigan counties or groups of counties,[37] and seventeen out-of-state Standard Metropolitan Statistical Areas (Appendix D, Table 19).

A major problem in utilizing travel time as a function of distance in the interaction model is the derivation of a weight for this component. Probably one reason why travel models of this type have not been developed is the lack of data leading to information on the "range" of travel of campers. This "range" or "distance decay function" for camping in Michigan State

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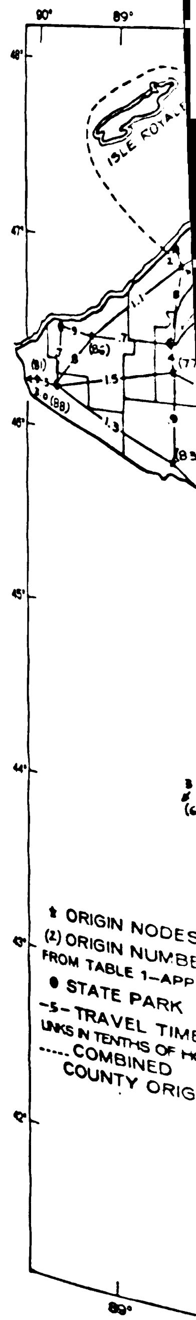
[36]The average speed in miles per hour for each link is an estimate based on the type of highway, two- or four-lane or limited access interstate, the topography traversed, and the urban or rural land use adjacent to each link. Major highway links without limited access which traversed urban areas were assigned speeds as low as 25 miles per hour in a few cases. Once the speed of traversing each link was estimated, it was divided into the highway mileage to obtain travel times.

[37]Several counties in Michigan with populations of less than 10,000, primarily in northern Michigan, were combined into one node to reduce the number of links. This was necessary for the systems model used for MORDS. To facilitate comparison of the two travel models at a later date, these counties were not separated for use in this study.



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Parks has never been derived. As a consequence, an estimate of this parameter is obtained in Chapter V on the basis of a sample of Michigan camping permits, using a probability method and a regression analysis.

Summary

Three components of a recreational travel model--supply, demand, and distance--have been identified and defined. The primary component of the three is supply. Three elements that influence the supply component or, in this case, the attractiveness of a state park for camping--activity opportunities, natural resources, and facilities and services--are standard considerations in planning state parks. Although these elements and their associated variables appear frequently in the literature, no one has attempted to combine them into a comprehensive measure of park attractiveness.

A review of outdoor recreational survey and planning studies served to identify the most important variables identified with each element. Recent state and national surveys were analyzed to recognize the most important outdoor activities preferred by campers. The same literature allowed for an estimation of the importance of each

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of each outdoor activity and the application of weighting scale. Each Michigan State Park was scaled as to total outdoor activity opportunities.

The variables of the remaining two elements of the supply component were then identified and discussed. Resource and facility and service variables were assigned a numerical value for use in a factor analysis. In Chapter IV these two elements are grouped and scaled in a manner that is useful for constructing a camping attraction index for each park.

Finally the remaining two components of a travel model were operationally defined. The demand component consists of two separate sets of data--estimates of camping participation obtained from a national survey and primary data obtained from the Michigan Department of Conservation. The distance component is based on an estimate of travel time between origin nodes and individual parks. The manner in which these two components are used in the travel model will be discussed in Chapter V.

CHAPTER IV

THE INDEX OF CAMPING ATTRACTION

Given the many variables inventoried for each Michigan State Park, the next step is to combine them into a meaningful index that will reflect the attraction of each park for camping. In order to reduce the variables measured into a smaller and more manageable number of dimensions and to analyze the magnitude of association between them, multiple-factor analysis is used. This method does not require selection of independent or dependent variables. It is, rather, a technique for finding the similarities or interrelationships among a large number of items which are not clear by inspection. The assumption is that the intercorrelations of several variables may indicate distinct groupings called factors. Thus factors are representative of the combined traits or characteristics of the variables.[1]

In this study, factor analysis is used to group a large number of variables related to camping into a relatively few explanatory factors. Judgment is present since results of various models depend on the original scaling of the variables.[2] In a given scale, however, the criteria are relatively clear and objective for evaluating any one of the models. The selection of the number and type of factors is determined by which (a) is most realistic in terms of acceptable theory and (b) explains the highest proportion of the total variance in the data. Once a particular model is accepted, the results are used to construct a numerical index of park quality.

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[1]For a more concise explanation of factor analysis, the reader is referred to Hubert M. Blalock, Social Statistics (New York: McGraw-Hill Book Co., 1960), pp. 383-389. Blalock describes factor analysis, on p. 383, as "a technique which can be used to take a large number of operational indices and reduce these to a smaller number of conceptual variables." A more detailed and sophisticated discussion of factor analysis can be found in H. H. Harmon, Modern Factor Analysis (Chicago: University of Chicago Press, 1962).

[2]For example, in a study using the same variables but different scaling, somewhat different numbers and types of factors were identified. See Jack B. Ellis, "The Description and Analysis of Socio-Economic Systems by Physical Systems Techniques" (unpublished Ph.D. dissertation, Dept. of Electrical Engineering, Michigan State University, 1965), p. 16.

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The Factor Analysis

Seventy-two natural-cultural, facility and service, and activity variables have been inventoried and scaled numerically for each Michigan State Park (see Appendix D, Table 18). Fifty-five of the seventy-two items are initially selected as representative of a park's attraction.[3]

It was hypothesized that the fifty-five variables would collapse into three factors (Table 5) identical with the three elements of a recreation area selected in Chapter III. Results of the initial varimax factor analysis[4] with the fifty-five selected variables did not, however, strictly confirm the hypothesis of the three factor grouping--natural resource environment, outdoor activities, and facilities and services. The solution on Model One indicates a strong inland lakes

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[3]These fifty-five variables were selected with the assistance of L. M. Reid, Professor of Parks and Recreation, Department of Parks and Recreation, Texas A. & M. College.

[4]The Fanod 4 Library program on the CDC 3600 Computer was used. This program produces the means and standard deviations of the variables, a correlation matrix, eigenvalues, principal axis factor loadings, quartimax or varimax factor loadings, proportions of total variance of each rotated factor, and the communality of each variable. For further details, see Factor Analysis Programs: Fanod 3 and Famin 3, Computer Institute for Social Science Research, Technical Report 2 (rev.; East Lansing, Mich.: Michigan State University, September 22, 1964).

TABLE 5.--Fifty-five variables used in first factor analysis model.

Hypothesis Factor I

Natural Environment (16 variables)

Park size (1)[a]	Average July temperature (20)
Local relief (5)	Springs (15)
Park surface (6)	Cliffs and overlooks (17)
Area surface (7)	Falls (16)
Vegetation (8)	Great Lakes frontage (36)
Virgin timber (9)	River frontage (48)
Wilderness characteristics (10)	Acreage of inland lakes (53)
Sand dunes (18)	Shade in campground (27)

Hypothesis Factor II

Outdoor Activities and Related Facilities and Services (27 variables)

Historical feature(s) (11)	Dry beach composition-Great Lakes (40)
Interpretative facilities (19)	Dry beach composition-inland lake (60)
Length of foot trails (31)	Beach width-Great Lakes (39)
Length of bridle trails (29)	Beach width-inland lake (59)
Rifle range (32)	Length of beach-Great Lakes (37)
Archery range (33)	Length of beach-inland lake (58)
Great Lakes water temperature-July (38)	Wet beach composition-Great Lakes (41)
Inland lake water temperature-July (56)	Wet beach composition-inland lake (61)

TABLE 5.--Contd.

Hypothesis Factor II - Contd.	
Swimming-Great Lakes (43)	Wet beach distance to 5'-Great Lakes (42)
Swimming-inland lake (63)	Wet beach distance to 5'-inland lake (62)
Fishing opportunity-Great Lakes (46)	Boat launching-inland lake (66)
Fishing opportunity-inland lake (72)	Extent of navigable waters-inland lake (69)
Fishing opportunity-river (50)	Waterskiing (70)
Boat launching-river (51)	
Hypothesis Factor III	
Facilities and Services (12 variables)	
Number of campsites (2)	Bathhouse-Great Lakes (44)
Campground store (21)	Bathhouse-inland lake (64)
Showers (22)	Lifeguard-Great Lakes (45)
Toilets-flush or box (23)	Lifeguard-inland lake (65)
Laundry (24)	Piers (47)
Campsites with electricity (25)	Boat rental-inland lake (67)

[a]Numbers after each variable refer to their numerical designation in Appendix D, Table 18.

factor combining all natural features, water activites, and facilities and services associated with inland lakes. However, this factor also includes high loadings on Great Lakes variables, suggesting a total water resources factor. The second strongest factor is the natural environment, excluding variables on inland lakes and Great Lakes but including river and stream characteristics. The third combines all natural features and facility and service variables related to the camping experience, such as shade in the campground, showers, laundry, etc. This grouping also includes Great Lakes variables with loadings equal to those appearing on the first factor.

Solutions of the first model reveal a fault in the hypothesis. Analysis of the three factor model indicates that the natural resource variables do not group as one factor but are distributed among all the factors--a distribution which, upon inspection, is logical. For the first factor, while focusing on inland lakes, also includes activities and facilities related to the water resource. The second factor is essentially a scenic one of land features, but includes river features not included elsewhere. The third, camping amenities, is an acceptable activity factor consisting of natural resources and facilities related to the camping experience.

Analysis of the four-factor solution of the same model is more encouraging (Table 6). Essentially the same factors are evident that occurred for the three-factor solution, but the four-factor solution removes the Great Lakes characteristics from the third factor and groups them in the fourth. Great Lakes variables are still loading on the first and fourth factors however.

If four factors explain more variance than do three, might not five or six do better? To answer this question, five- and six-factor solutions of Model One were analyzed. A five-factor solution is not satisfactory conceptually. Many of the Great Lakes variables loaded equally on the fourth and fifth factors. The six-factor solution is similarly unsatisfactory in that its two dominant variables are rifle and archery ranges. These facilities are available in few parks but are not particularly important activities on a camping trip.

Using the criterion of proportion of total variance explained, the four-factor solution is preferable to the three factor hypothesis. The three-factor results

TABLE 6.--Factor loadings for First Model four-factor solution (55 variables) varimax rotation

Factor I (Inland Lakes) Proportion of Variance Explained = 20%		Factor II (Natural Environment) Proportion of Variance Explained = 14%	
Variable	Factor Loading	Variable	Factor Loading
Swimming	-.9435	Acreage of park	.9215
Water skiing	-.9377	River frontage	.8937
Dry beach composition	-.9340	Hiking	.8865
Average July water temp.	-.9228	Local relief	.8301
Wet beach composition	-.8910	Great Lakes frontage	.8158
Fishing quality--inland lakes	-.8607	Falls	.7654
Lifeguard	-.8469	Wilderness	.7320
Bathhouse	-.7502	Vegetation	.6500
Wet beach distance to 5'	-.6758	Virgin timber	.5923
Beach width	-.6346	Springs	.5908
Boat rental	-.6303	Boating--river	.4870
Boat launching site	-.5265	Cliffs	.4591
Navigable waters	-.4764	Fishing quality--river	.4461
		Historic	.4334
		Interpretative	.3517

TABLE 6.--Contd.

Factor III (Camping Amenities) Proportion of Variance Explained = 10%		Factor IV (Great Lakes) Proportion of Variance Explained = 10%	
Variable	Factor Loading	Variable	Factor Loading
Showers	-.8341	Pier	.7311
Toilets	-.8032	Lifeguard	.7292
Laundry	-.7659	Fishing quality-Great Lakes	.7080
Sites with electricity	-.7012	Bathhouse	.6792
Number of campsites	-.6079	Wet beach composition	.6438
Shade in campground	-.5197	Sand dunes	.6043
Average July temperature	.5176	Beach width	.5872
Rifle range	.4862	Length of beach	.3221
Bridle trails	.4724		
Archery range	.4517		
Store	-.3644		

Total Variance Explained = 54%

explain 48 per cent, while the four factor solution explains 54 per cent of the total variance (Table 7). The five-factor solution, accounting for 57 per cent of total variance, and the six-factor solution, for 62 per cent, explain a higher proportion of variance, but in terms of the grouping of variables they are unacceptable on intuitive grounds. Consequently, the four-factor solution is judged to be the most desirable to use.

Several additional models are conducted to confirm whether the four-factor solution is best and to increase the amount of total variance explained for four factors. These models are summarized in Table 7.

Twenty-four variables are deleted in Model Two, including all activity variables.[5] This model proves to be the best solution in terms of the total variance explained (64%) by the four factors (Table 7). But in spite of the large amount of the total variance explained by the four factors on Model Two, this solution is not used in constructing the index. By using only thirty-one variables, too many important facility and service

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[5]These variables in Model One are entered as binary values. Henceforth, activity opportunities at each park are scored separately in the index on the basis of the empirical weights established in Chapter III.

TABLE 7.--Summary table of factor analysis models - varimax rotation

		Proportion of Variance Explained by						Variables from Previous Run	
		Factor			Total				
Model Number	Number of Variables	I	II	III	3 Factors	4 Factors	5 Factors	Deleted	Added
1	55	22	14	12	48	54	58		
2	31	22	20	14	56	64	69	Number of campsites, outpost camps, museum, interpretative, July air temp., hiking trails, length of beach-G.L., acreage-i.l., beach frontage-i.l.	

TABLE 7.--Contd.

Model Number	Number of Variables	Proportion of Variance Explained by						Variables From Previous Run	
		Factor			Total				
		I	II	III	3 Factors	4 Factors	5 Factors	Deleted	Added
3	47	19	16	13	48	55	60		Number of camp-sites, outpost camps, museum, av. July temp., hiking trails, play equip., frontage G.L., wet beach distance-i.L. and G.L., fishing quality-i.L., rivers, acreage i.L., beach frontage-i.L., boat launch, boat rental.

TABLE 7.--Contd.

		Proportion of Variance Explained by						Variables From Previous Run	
		Factor			Total				
Model Number	Number of Variables	I	II	III	3 Factors	4 Factors	5 Factors	Deleted	Added
4	46	20	14	14	48	54	59	Acreage of park	
5	43	18	15	11	44	56	61	Museum, wet beach dis-tance-i.L. and G.L.	

variables are eliminated from the analysis--perhaps some of these should be included in an attraction index. Many of these facility and service variables--such as fishing quality, hiking trails, boat launching ramps, and boat rental--are believed to be necessary for successfully undertaking many of the activities preferred by campers. Another weakness in Model Two is the persistence of high factor loadings for the Great Lakes variables in the inland lakes as well as the Great Lakes factor. These two water resources provide somewhat different activity opportunities. For purposes of the index, a stronger contrast is desirable.

An effort to achieve the highest explained variance via four factors, using variables thought to be directly associated with outdoor activities preferred by campers, is continued on a trial-and-error basis. Model Three includes many of the variables previously deleted from the analysis and does not include any of the activity variables. The total amount of variance explained by the four factors on Model Three is 55 per cent, a reduction from the 64 per cent achieved on Model Two (Table 7).

On Model Four, the acreage of each park is eliminated as a variable without substantially lowering the total explained variance. This is done on the basis that some of the most popular camping parks are very small in acreage, suggesting that campers may find amenities desired for camping and preferred outdoor activities regardless of a park's size.

The last factor analysis, Model Five, includes forty-three variables. The major difference between this and the original model is that all activity variables are excluded. Also excluded are selected natural-cultural and facility and service variables with very low communalities or factor loadings with signs opposite to those of the majority of variables on a particular factor. The variables used in Model Five produce the most acceptable combination of loading of Great Lakes variables on the Great Lakes factor and depresses these loadings on the inland lakes factor.[6] The distribution of forty-one of

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[6]The more acceptable factor loading of the Great Lakes variables on Model Five is one of the major differences between Models Five and Two. If the goal is to identify the fewest variables possible for a model with the highest explained variance, then Model Two should be used for compiling the index. However, by a trial-and-error method, Model Five proved to be the best analysis that includes the variables intuitively plausible and more acceptably loaded in the index. By using Model Five, the explained variance is reduced from 64 per cent to 56 per cent. Pragmatically, the difference between Model Five and Model Two for purposes of index construction is not important. This is verified by constructing

the forty-three variables on each factor and their loadings are listed in Table 8. Two variables--outpost camps and average July air temperatures at parks--are dropped from the analysis at this point. These two variables load negatively on the third factor and can not be used in the factor-scoring routine to be used in calculating the composite index.

Given that the various models tend to explain from 49 per cent to 69 per cent of the total variance in the data, how reliable are the results for managerial decisions? In the light of the rudimentary state of research in this field, these percentages are acceptable. The 56 per cent explanation in Model Five, the one actually used for index construction, is without activity scores, which would presumably account for a reasonable percentage of the remaining variance. Improvements in data reliability might further reduce the unexplained "noise" or variance in the system by a significant amount.

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an index with the factor loadings from Model Two. This index, compared with the index listed in Table 11, is basically the same. Thirty-eight parks on the Model Two index went down, while twenty-one parks went up in value. However, only thirteen parks went up or down by more than 5 index points, and only two parks--Gogebic, -11.9; and Ludington, -15.9--differed by more than 10 index points.

TABLE 8.--Factor loadings for Model Five, four-factor solution - varimax rotation (43 variables)*

Factor I (Water--Inland Lakes)		Factor II (Land--Physical Environment)	
Proportion of Variance Explained = 18%		Proportion of Variance Explained = 15%	
Variable	Factor Loading	Variable	Factor Loading
Dry beach composition	-.9067	Hiking trails	.8804
Average July water temp.	-.8923	River frontage	.8755
Wet beach composition	-.8722	Great Lakes frontage	.8534
Lifeguard	-.8601	Local relief	.7940
Fishing quality	-.8280	Falls	.7760
Bathhouse	-.7210	Wilderness	.7624
Beach width	-.6782	Vegetation	.6817
Boat rental	-.6680	Springs	.6297
Boat launching	-.5400	Virgin timber	.6015
Beach frontage	-.4968	Historic	.4500
Acreage of inland lakes	-.4622	Cliffs - overlooks	.4429
		Fishing quality river	.4224

TABLE 8.--Contd.

Factor III (Camping Amenities)		Factor IV (Water--Great Lakes)	
Proportion of Variance Explained = 11%		Proportion of Variance Explained = 12%	
Variable	Factor Loading	Variable	Factor Loading
Showers	.8736	Lifeguard	-.7611
Toilets	.8350	Pier	-.7342
Laundry	.8060	Bathhouse	-.7200
Campsites with electricity	.7039	Wet beach composition	-.7068
Number of campsites	.5666	Fishing quality	-.7043
Percent of shade in campground	.4747	Dry beach composition	-.6961
Store	.3846	Beach width	-.6139
Playground equipment	.3293	Average July water temp.	-.5686
		Sand dunes	-.5658
		Length of beach	-.3246

Total Variance Explained = 56%

*In computing the index of attraction from this run, two variables were dropped: outpost camps and average July air temperature. These variables loaded negatively on FACTOR III, and could not be used in the WRAP scoring routine.

Calculation of the Camping Attraction Index

The camping attraction index for each park is derived directly from factor loadings of the forty-one variables. For example, if a park is located on an inland lake and contains all of the variables listed under the first factor, all of these variables are used in computing a single inland lake factor score for this park. It is assumed that all variables are unweighted. Then, to obtain the single factor score for the inland lake characteristic of this park, weights are assigned according to the factor loadings of each variable under the first factor. Thus a variable factor loading of .91 would result in a weight of 05.294, while a factor loading of .66 would have a weight of 01.169. These weights are determined by the formula:

$$W = \frac{r}{1-r^2}$$

where r is a factor loading for one variable and W is a factor loading weight (see Table 9 for weights).

The remaining three factors for the park are similarly assigned weights. If the park is not located on the Great Lakes, then no weights are assigned and it can be expected to receive a lower overall index. After the

TABLE 9.--Formula and factor loading weights for WRAP program

Formula: r = factor loading

$$\text{weight} = \frac{r}{1 - r^2}$$

Loading	Weight	Loading	Weight	Loading	Weight
20	00.208	46	00.583	76	01.800
21	00.220	47	00.603	77	01.891
22	00.231	48	00.624	78	01.992
23	00.243	49	00.645	79	02.102
24	00.255	50	00.667	80	02.222
25	00.267				
		51	00.689	81	02.355
26	00.279	52	00.713	82	02.503
27	00.291	53	00.737	83	02.668
28	00.304	54	00.762	84	02.853
29	00.317	55	00.789	85	03.063
30	00.330				
		56	00.816	86	03.303
31	00.343	57	00.844	87	03.579
32	00.357	58	00.874	88	03.901
33	00.370	59	00.905	89	04.281
34	00.384	60	00.938	90	04.737
35	00.399				
		61	00.971	91	05.294
36	00.414	62	01.007	92	05.990
37	00.429	63	01.045	93	06.884
38	00.444	64	01.084	94	08.076
39	00.460	65	01.126	95	09.744
40	00.476				
		66	01.169	96	12.245
41	00.493	67	01.216	97	16.413
42	00.510	68	01.265	98	24.747
43	00.528	69	01.317	99	49.749
44	00.546	70	01.373	100	------
45	00.564				

TABLE 9.--Contd.

Loading	Weight	Loading	Weight	Loading	Weight
		71	01.432		
		72	01.495		
		73	01.563		
		74	01.636		
		75	01.714		

Source: Weighting Ranking and Printing (WRAP) was programmed by James Clark, Department of Psychology, Michigan State University.

weights for individual variables under each of the four factors are assigned, the single factor score for each park is obtained.[7]

Four scores are thus derived for each park--one for inland lakes, natural resources, camping amenities, and the Great Lakes. If a park is not endowed with one of the factors, then one or more of the single factor scores will be 0.00 (see, for example, the inland lakes score for Algonac State Park on Table 10). The four derived scores are standardized with a mean of 0.00 and a standard deviation of 1.00. The results are listed in Table 10 and Table 11 with each park's activity score from Table 4. Since the attraction index is more uniform numerically if standardized around a mean of 100, with a standard deviation of 50, these additional transformations are made. Thus Aloha, with a score of 1.26 on the inland lake factor, is adjusted to 163 with the base 100 and a standard deviation of 50. A park like Bald Mountain, with a negative score on inland lakes of -.39, is

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[7]The WRAP computer program developed by James Clark of the Department of Psychology at Michigan State University was used. The program computes an estimate of the factor scores for a given factor analysis by selecting sub-sets of variables which are representative of each factor (Table 9), and computes the regression between these factors and factor loadings.

TABLE 10.--Standardized park scores[a] ($\bar{X}$ = 0, σ = 1)[b]

Park	I Inland Lakes	II Physical Environ.	III Camping Amenities	IV Great Lakes	V Activity Scores
	Factors				
Algonac	0.00[c]	-.17	-.57	0.00	-.93
Aloha	1.26	.34	.93	0.00	.49
Bald Mountain	-.39	0.07	-1.63	0.00	-.83
Baraga	0.00	-.27	.53	.39	.10
Bay City	-.87	-.31	1.04	.59	-.78
Benzie	0.00	-.11	-1.32	-1.29	-.98
Brighton	1.40	-.27	-1.40	0.00	1.18
Brimley	0.00	-.08	.78	-.03	.83
Burt Lake	1.18	-.09	.91	0.00	1.13
Cheboygan	0.00	-.26	-1.67	-.61	-.88
D.H. Day	-.75	.45	-1.46	-.50	-.93
East Tawas	0.00	-.32	.56	1.76	-.44
Fayette	0.00	.09	-1.53	-.82	-.88
Fort Wilkins	-.62	.00	.53	-1.36	-.54
Gladwin	0.00	-.20	.45	0.00	-1.52
Gogebic	1.09	-.07	.73	0.00	.83
Grand Haven	0.00	-.16	.61	2.10	-.39
Harrisville	0.00	-.18	.76	-.77	-.54
Hartwick Pines	-.87	.89	.54	0.00	-.78
W.J. Hayes	1.29	-.12	.81	0.00	.49
Higgins Lake	1.44	-.13	1.49	0.00	.83
Highland	-.57	-.13	-1.46	0.00	.93
P.H. Hoeft	0.00	-.08	.10	-.35	.00
Holland	-.85	-.33	.92	1.75	.05
Holly	1.20	.17	-1.38	0.00	1.27
Indian Lake	.96	-.02	.67	0.00	1.17
Interlochen	1.32	-.23	.80	0.00	.49
Island Lake	1.24	.07	-1.48	0.00	1.37
Lakeport	0.00	-.28	.90	.13	-.88
Ludington	1.18	1.57	1.01	.53	2.06
McLain	0.00	-.10	-.65	-1.13	-1.18
Mears	0.00	-.24	.49	2.11	-.73

TABLE 10.-

Metamora-Hadley
Mitchell
Muskallong Lake
Muskegon
Onaway
Orchard Be
Ortonville
Otsego Lak
Pinckney
Pontiac La
Porcupine Mountains
Port Cresce
Proud Lake
Silver Lake
Sleeper
Straits
Tahquamenon Falls
Traverse Ci
Van Riper
Warren Dune
Waterloo
J.W. Wells
White Cloud
Wilderness
Wilson
Yankee Springs
Young

TABLE 10.--Contd.

	Factors				
	I	II	III	IV	V
Metamora-Hadley	.64	-.25	.58	0.00	.10
Mitchell	1.24	-.34	.61	0.00	.49
Muskallonge Lake	.55	-.07	-1.44	-1.26	.39
Muskegon	-.68	.49	.86	2.34	1.08
Onaway	.24	-.15	.51	0.00	.83
Orchard Beach	0.00	-.23	.61	-.44	-1.18
Ortonville	.69	-.17	-1.45	0.00	.93
Otsego Lake	1.30	-.23	.85	0.00	.49
Pinckney	1.21	.25	-.35	0.00	.93
Pontiac Lake	1.48	.08	-1.60	0.00	.98
Porcupine Mountains	-.70	6.65	-.72	-.31	1.32
Port Crescent	0.00	0.24	.25	-.24	-.34
Proud Lake	.60	.44	-1.37	0.00	1.47
Silver Lake	1.45	.50	.78	-.01	.49
Sleeper	-.74	-.26	.95	.60	-.44
Straits	0.00	.02	.58	-.20	-1.57
Tahquamenon Falls	0.00	2.42	.77	-1.11	-.29
Traverse City	0.00	-.23	1.04	-.46	-.78
Van Riper	1.41	.05	-.41	-.32	1.47
Warren Dunes	0.00	.22	.73	0.00	-.63
Waterloo	1.02	.13	-.44	.72	1.27
J.W. Wells	0.00	.59	.61	0.00	-.15
White Cloud	0.00	.01	.35	.03	-1.62
Wilderness	0.00	1.74	.71	0.00	-.10
Wilson	1.08	-.22	.76	-.32	.49
Yankee Springs	1.38	.14	.74	0.00	.73
Young	1.26	-.31	.64	0.00	.39

TABLE 10.--Contd.

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[a]Sources: Factor scores from WRAP program; activity score from Table 4.

[b]On Factors I and IV the signs have been reversed since all factor loadings were negative.

[c]0.00 indicates the park did not include inland lakes or was not located on the Great Lakes.

multiplied by 50; this product is subtracted from 100, to give an adjusted score of 80.5 on this factor. The set of adjusted park scores for each of the four factors and the activity score for the park are listed in Table 11.

To obtain the attraction index, each of the five adjusted scores for an individual park are summed and the total divided by five to preserve the standardization. In the absence of strong evidence suggesting any other weighting, this provides an equal weight for each score. The indexes derived for each of the fifty-nine Michigan State Parks where camping is allowed are listed in Table 11 and mapped in Figure 6.

Revision of the Attraction Index

Use of the camping attraction index in the interaction model may inadequately represent the pulling power for each park. An apparent weakness of the index is that it considers only internal (site) characteristics of each park; it does not actually take into account attractions outside the confines of a park (situation). Thus, attendance at a few parks, particularly in the Upper Peninsula, may be underpredicted by the travel model. The location of parks situated within or near recreational attractions, or a complex of attractions,

TABLE 11.--Adjusted park scores ($\overline{X} = 100$, $\sigma = 50$)

Park	I Inland Lakes	II Physical Environ.	III Camping Amenities	IV Great Lakes	V Activity Scores	Sum Cols. I to V	Index Total÷5
Algonac	0.00	91.5	71.5	0.00	53.5	216.0	043.2
Aloha	163.0	83.0	146.0	0.00	124.5	516.0	103.2
Bald Mountain	80.5	96.5	18.5	0.00	58.5	254.0	050.8
Baraga	0.00	86.5	126.5	119.5	105.0	437.5	087.5
Bay City	56.5	84.5	152.0	129.5	61.0	483.5	096.7
Benzie	0.00	94.5	34.0	35.5	51.0	215.0	043.0
Brighton	170.0	86.5	30.0	0.00	159.0	445.0	089.0
Brimley	0.00	96.0	61.0	98.5	58.5	372.0	074.4
Burt Lake	159.0	95.5	145.5	0.00	156.5	556.5	111.3
Cheboygan	0.00	87.0	16.5	69.5	56.0	229.0	045.8
D.H. Day	62.5	122.5	27.0	75.0	53.5	340.5	068.1
East Tawas	0.00	84.0	128.0	188.0	88.0	488.0	097.6
Fayette	0.00	104.5	23.5	59.0	56.0	243.0	048.6
Fort Wilkins	69.0	100.0	126.5	32.0	63.0	390.5	078.1
Gladwin	0.00	90.0	122.5	0.00	24.0	236.0	047.2
Gogebic	154.5	96.5	136.5	0.00	141.5	570.5	114.1
Grand Haven	0.00	92.0	130.5	205.0	80.5	508.0	101.6
Harrisville	0.00	91.0	138.0	61.5	63.0	353.5	070.7
Hartwick Pines	56.5	144.5	127.0	0.00	61.0	389.0	077.4

TABLE 11.--Contd.

Park	I Inland Lakes	II Physical Environ.	III Camping Amenities	IV Great Lakes	V Activity Scores	Sum Cols. I to V	Index Total÷5
W.J. Hayes	164.5	94.0	140.5	0.00	124.5	523.5	104.7
Higgins Lake	172.0	93.5	174.5	0.00	141.5	581.5	116.8
Highland	128.5	93.5	27.0	0.00	146.5	395.5	079.1
P.H. Hoeft	0.00	96.0	105.0	82.5	100.0	383.0	076.6
Holland	57.5	83.5	146.0	187.0	102.5	576.0	115.2
Holly	160.0	108.5	31.0	0.00	163.5	463.0	092.6
Indian Lake	148.0	99.0	133.5	0.00	158.5	539.5	107.9
Interlochen	166.0	88.5	140.0	0.00	124.5	519.0	103.8
Island Lake	162.0	103.5	26.0	0.00	168.5	460.0	092.0
Lakeport	0.00	86.0	145.0	93.5	56.0	380.0	076.0
Ludington	159.0	178.5	150.5	126.5	203.0	817.0	163.4
McLain	0.00	95.0	67.5	43.5	41.0	247.0	049.4
Mears	0.00	82.0	124.5	205.5	63.5	475.5	095.2
Metamora-Hadley	132.0	87.5	129.0	0.00	105.0	453.5	090.7
Mitchell	162.0	83.0	130.5	0.00	124.5	500.0	100.0
Muskallonge Lake	127.5	96.5	28.0	37.0	119.5	408.5	081.7
Muskegon	66.0	124.5	143.0	217.0	154.0	704.5	140.9
Onaway	112.0	92.5	125.5	0.00	141.5	471.5	094.3
Orchard Beach	0.00	88.5	130.5	78.0	41.0	338.0	067.6
Ortonville	134.5	91.5	27.5	0.00	146.5	400.0	080.0

TABLE 11.--Contd.

Park	I Inland Lakes	II Physical Environ.	III Camping Amenities	IV Great Lakes	V Activity Scores	Sum Cols. I to V	Index Total÷5
Otsego Lake	165.0	88.5	142.5	0.00	124.5	545.0	109.0
Pinckney	160.5	112.5	82.5	0.00	146.5	502.0	100.4
Pontiac Lake	174.0	104.0	20.0	0.00	149.0	447.0	089.4
Porcupine Mountains	65.0	432.0	64.0	84.5	166.0	811.5	162.3
Port Crescent	0.00	88.0	112.5	88.0	83.0	371.5	074.3
Proud Lake	130.0	122.0	31.5	0.00	173.5	457.0	091.4
Silver Lake	172.5	125.0	139.0	99.5	124.5	660.0	132.0
Sleeper	63.0	87.0	147.5	130.0	78.0	505.5	101.1
Straits	0.00	101.0	129.0	44.5	21.5	296.0	059.2
Tahquamenon Falls	0.00	221.0	138.5	77.0	85.5	522.0	104.4
Traverse City	0.00	88.5	152.0	84.0	61.0	385.5	077.1
Van Riper	170.0	102.5	79.5	0.00	173.5	525.5	105.1
Warren Dunes	0.00	111.0	136.5	136.0	68.5	452.0	090.4
Waterloo	151.0	106.5	78.0	0.00	163.5	499.0	099.8
J.W. Wells	0.00	70.5	130.5	101.5	92.5	395.0	079.0
White Cloud	0.00	100.5	117.5	0.00	19.0	237.0	047.4
Wilderness	0.00	187.0	135.5	84.0	84.0	490.0	098.0
Wilson	154.0	89.0	138.0	0.00	124.5	505.5	101.1
Yankee Springs	169.0	107.0	137.0	0.00	136.5	549.0	109.8
Young	163.0	84.5	132.0	0.00	119.5	499.0	099.8

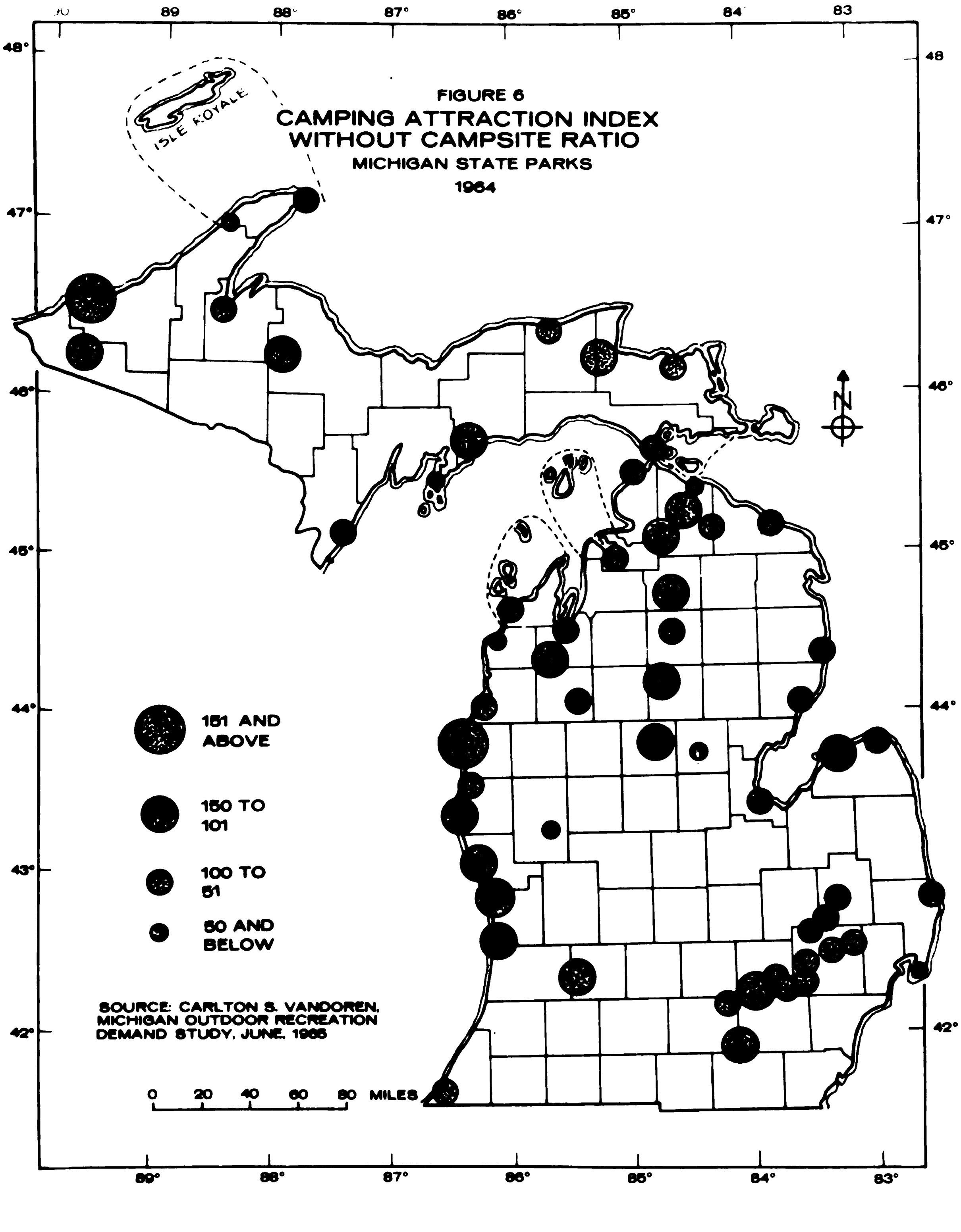
FIGURE 6
CAMPING ATTRACTION INDEX
WITHOUT CAMPSITE RATIO
MICHIGAN STATE PARKS
1964
ISLE ROYALE
151 AND ABOVE
150 TO 101
100 TO 51
50 AND BELOW
SOURCE: CARLTON S. VANDOREN, MICHIGAN OUTDOOR RECREATION DEMAND STUDY, JUNE, 1965
0 20 40 60 80 MILES
N
89
88°
87°
86°
85°
84
83
48°
47°
46°
45°
44°
43°
42°

may constitute an additional pulling power for these parks. Examples are Fort Wilkins in the Keweenaw Peninsula and Brimley near the Soo Locks. This omission cannot be fully evaluated at this point.

One modification, however, recognized as essential in improving the index, is the use of a campground capacity weight for each park. When the index for each park is multiplied by the ratio of the number of campsites in that park to the mean number of campsites in the Michigan State Park System (181 campsites), the attraction index should be a much more successful component in the travel model.[8] This is analogous to using a location quotient.

The index weighted by the campsite ratio is listed in Table 12. Notice that parks with high attraction indices, when weighted by this capacity figure, generally are elevated in attractiveness. Examples are Ludington, Holland, and Higgins Lake. Some parks, such as Gogebic and Otsego Lake, remain the same. Others, such as Indian Lake and Porcupine Mountains, are lowered.

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[8]From Table 8 it can be seen that the number of campsites in each park was included under Factor III--Camping Amenities. The camping capacity of each park proved to be a stronger component within the system than anticipated, and the relatively low factor loading on Factor III did not sufficiently influence the total index.

TABLE 12.--Revised index of attraction with campsite ratio

Park	No.	Original Index	Number of Campsites	Capacity Ratio	Revised Index
Algonac	01	43.2	218	1.20	51.8
Aloha	02	103.2	306	1.69	174.4
Bald Mountain	03	50.8	40	.22	11.2
Baraga	04	87.5	97	.54	47.2
Bay City	05	96.7	300	1.66	160.5
Benzie	06	43.0	125	.69	29.7
Brighton	07	89.0	219	1.21	107.7
Brimley	08	74.4	205	1.13	84.1
Burt Lake	09	111.3	232	1.28	142.5
Cheboygan	10	45.8	35	.19	8.7
D.H. Day	11	68.1	125	.69	47.0
East Tawas	12	97.6	185	1.02	99.6
Fayette	13	48.6	40	.22	10.7
Fort Wilkins	14	78.1	80	.44	34.4
Gladwin	15	47.2	65	.36	17.0
Gogebic	16	114.1	180	.99	113.0
Grand Haven	17	101.6	237	1.31	133.1
Harrisville	18	70.7	227	1.25	88.4
Hartwick Pines	19	71.6	45	.25	17.9
W.J. Hayes	20	104.7	202	1.12	117.3
Higgins Lake	21	116.3	582	3.22	374.5
Highland	22	79.1	40	.22	17.4
P.H. Hoeft	23	76.6	120	.66	50.6
Holland	24	115.2	376	2.08	239.6
Holly	25	92.6	195	1.08	100.0
Indian Lake	26	107.9	165	.91	98.2
Interlochen	27	108.8	487	2.69	279.2
Island Lake	28	92.0	103	.57	52.4
Lake Port	29	76.0	252	1.39	105.6
Ludington	30	163.4	299	1.65	269.6
McLain	31	49.4	94	.52	25.7
Mears	32	95.2	90	.50	47.6
Metamora-Hadley	33	90.7	145	.80	72.5

Table 12.--Contd.

Park	No.	Orig- inal Index	Number of Camp- sites	Capacity Ratio	Revised Index
Mitchell	34	100.0	180	1.00	100.0
Muskallonge Lake	35	81.7	150	.83	67.8
Muskegon	36	140.9	214	1.18	166.3
Onaway	37	94.3	91	.50	47.2
Orchard Beach	38	67.6	180	1.00	67.6
Ortonville	39	80.0	40	.22	17.6
Otsego Lake	40	109.0	192	1.06	115.5
Pinckney	41	100.4	301	1.66	166.7
Pontiac Lake	42	89.4	30	.17	15.2
Porcupine Mountains	43	162.3	131	.72	116.9
Port Crescent	44	74.3	180	1.00	74.3
Proud Lake	45	91.4	124	.69	63.1
Silver Lake	46	132.0	202	1.12	147.8
Sleeper	47	101.1	292	1.61	162.8
Straits	48	59.2	148	.82	48.5
Tahquamenon Falls	49	104.4	226	1.25	130.5
Traverse City	50	77.1	326	1.80	138.8
Van Riper	51	105.1	222	1.23	129.3
Warren Dunes	52	90.4	137	.76	68.7
Waterloo	53	99.8	288	1.59	158.7
J.W. Wells	54	79.0	150	.83	65.6
White Cloud	55	47.4	45	.25	11.8
Wilderness	56	98.0	205	1.13	110.7
Wilson	57	101.1	150	.83	83.9
Yankee Springs	58	109.8	252	1.39	152.6
Young	59	99.8	127	.70	69.9
TOTAL			10,694		

A majority of parks with indices of less than 100 are reduced by the capacity weighting; Cheboygan and White Cloud, with indices in the 40's, are lowered to less than 10 index points. The revised index for each park is illustrated in Figure 7.

The Attraction Index as a Measure of Attendance

Now that a camping attraction index has been developed for each Michigan State Park, the utility of the index in measuring the mass attractive power of each park remains to be tested. The relationship between the attraction index and camper-days at a park can be examined by a regression analysis. The attraction index is treated as the independent or causal variable and camper-days as the dependent or resultant variable. The regression equation $Y = 4814.38 + 418.07x$ expresses the relationship between the two variables, with a coefficient of determination (r^2) of +0.78.[9] The "explained variation," which exceeded 75 per cent, is evidence of a relatively high degree of correspondance between the

[9]This figure was significant at the 5 per cent confidence level with $T_B = 14.33$ and 57 degrees of freedom.

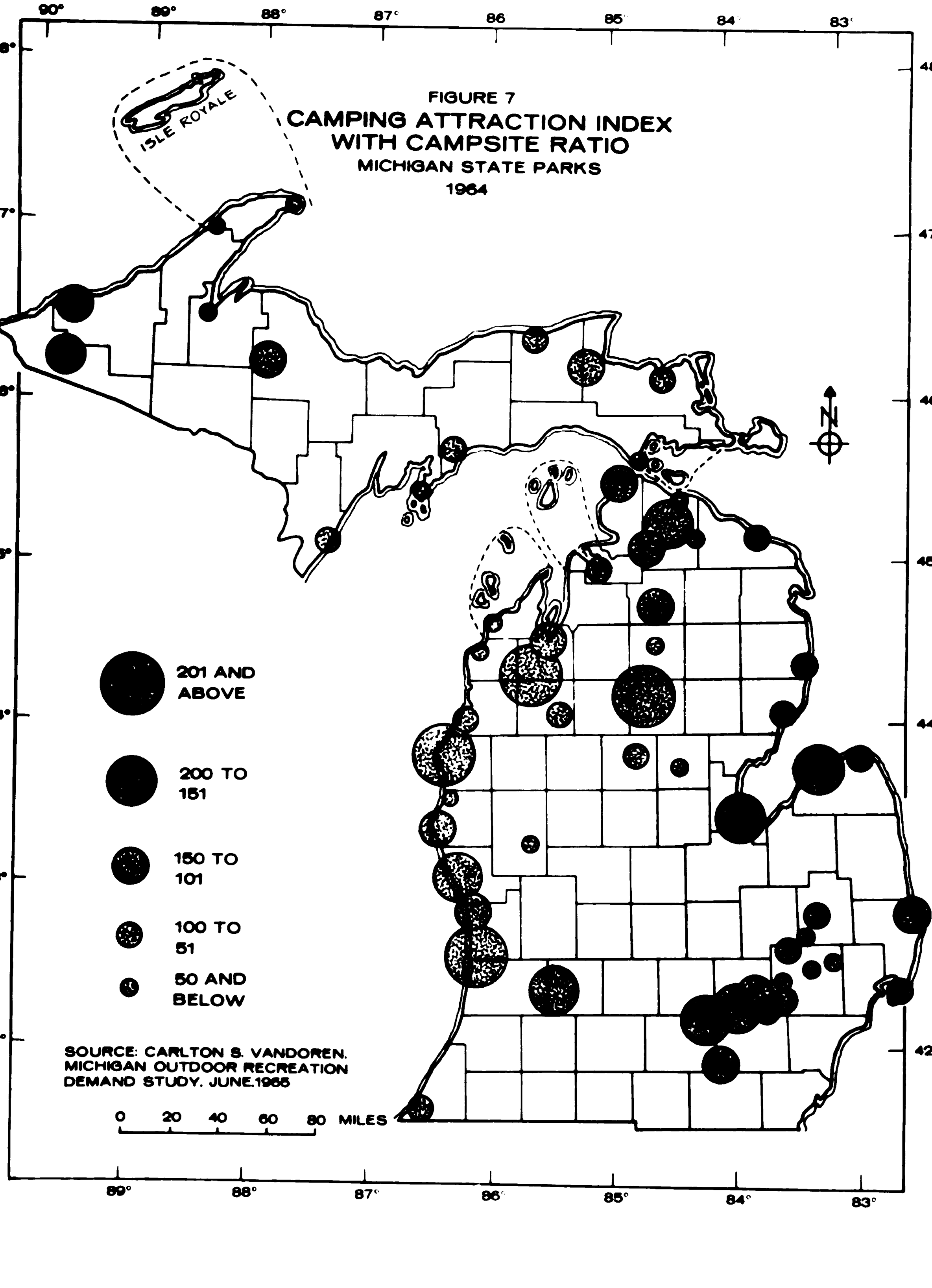
FIGURE 7
CAMPING ATTRACTION INDEX
WITH CAMPSITE RATIO
MICHIGAN STATE PARKS
1964
ISLE ROYALE
201 AND
ABOVE
200 TO
151
150 TO
101
100 TO
51
50 AND
BELOW
SOURCE: CARLTON S. VANDOREN.
MICHIGAN OUTDOOR RECREATION
DEMAND STUDY. JUNE.1966
0 20 40 60 80 MILES
N
90°
89°
88°
87°
86
85
84
83°
48°
47°
46°
45°
44°
43°
42°
48
47°
46°
45°
44°
42°

1964 camper-days at Michigan State Parks and the camping attraction index for each park.[10]

Since the attraction indices are to be used in an interaction model as a measure of camper-days, an analysis of the spatial pattern of the relative differences between the expected and actual values is useful. This analysis can be accomplished by mapping the residuals from the regression equation and thus pinpointing which parks have attraction indices that may not be reasonably representative of their true camping attraction. The utility of mapping residuals from regression for this purpose has been discussed by Thomas.[11] The value of the residual indicates the magnitude of the difference between the computed and observed values relative to the standard error of the estimate.[12] The residual $(Y-Y_c)/S_{Y_c}$ is mapped on Figure 8.

On the basis of the map of residuals, it is obvious

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[10] It should be pointed out that a regression equation between camper-days and the attraction indices without the adjustment for the number of campsites in each park yielded an r^2 of +0.31.

[11] Edwin N. Thomas, Maps of Residuals from Regression: Their Characteristics and Uses in Geographic Research (Iowa City: Department of Geography, State University of Iowa, 1960).

[12] S_{Y_c} is equal to 16,073 camper-days.

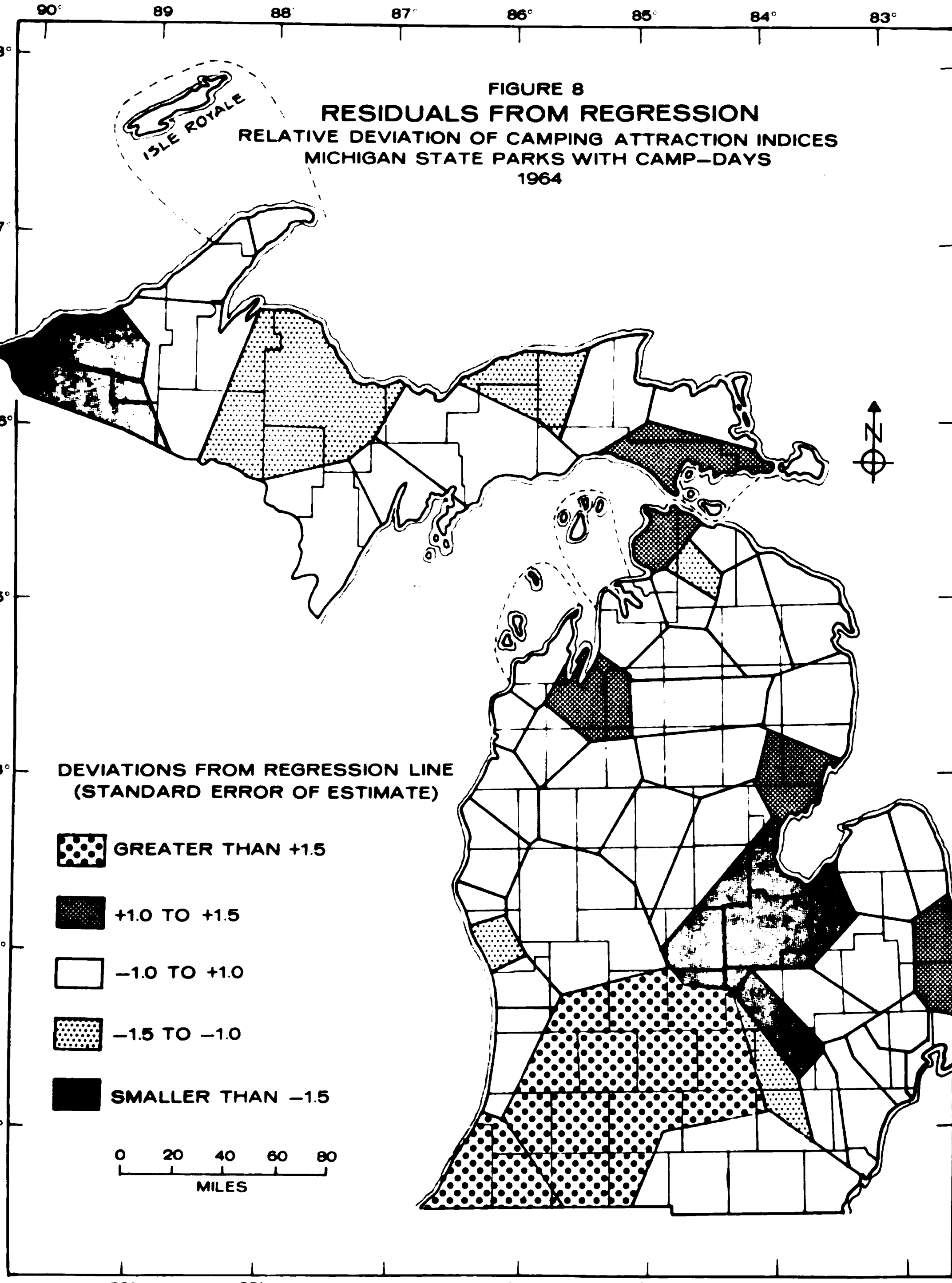
FIGURE 8
RESIDUALS FROM REGRESSION
RELATIVE DEVIATION OF CAMPING ATTRACTION INDICES
MICHIGAN STATE PARKS WITH CAMP-DAYS
1964
ISLE ROYALE
DEVIATIONS FROM REGRESSION LINE
(STANDARD ERROR OF ESTIMATE)
GREATER THAN +1.5
+1.0 TO +1.5
−1.0 TO +1.0
−1.5 TO −1.0
SMALLER THAN −1.5
0 20 40 60 80
MILES
N
90° 89 88° 87° 86° 85° 84° 83°
48° 47° 46° 45° 44° 43° 42°

that the attraction indices of eight parks with a S_{yc} of +1.0 or more can be expected to underpredict camper-days. Three of these parks in southwestern and southcentral Michigan--Warren Dunes, Yankee Springs, and Waterloo--have standardized error estimates in excess of +1.5. Algonac, East Tawas, Traverse City, and Wilderness, located in the lower Peninsula, and Straits, located in the Upper Peninsula, have estimates from +1.0 S_{yc} to +1.5 S_{yc}. The fact that these eight parks have under-predicting camper-days on the basis of their attraction indices can be explained by factors external to the parks. For example, Warren Dunes, Algonac, Wilderness, and Straits are located on major highways carrying a large volume of summer traffic. Many of their campers may be overnight campers enroute to other areas. Warren Dunes is the closest Michigan park to the Chicago Metropolitan Region; Algonac is within a few miles of a major international gateway between Michigan and Ontario, and Wilderness and Straits are located on both sides of the Straits of Mackinac. Traverse City State Park is located within the corporate limits of Traverse City and within a thriving resort region. East Tawas, like Traverse City, is a small park within the city limits.

Waterloo and Yankee Springs are both state recreation areas near large metropolitan areas and are also located in a part of the state where state parks are not numerous[13] (in the case of Waterloo this statement is true only if the areas north and west are considered). Since the attraction indices include internal characteristics, it is probable that the underprediction for these eight parks is due to a number of external factors.

An analysis of parks with negative deviations from the regression line is difficult. The nine parks with a deviation of -1.0 S_{yc} or less have overpredicted camper-days. Porcupine Mountains, Gogebic, Bay City, and Brighton have deviations of -1.5 S_{yc} or less. It is evident that the camping attraction index as derived is much higher for some of these parks than actual attendance of campers--for example, Pinckney, Brighton, Bay City, and Aloha. Attraction indices in these cases may indicate camping parks that are as yet "undiscovered"

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[13]The unit areas indicated on Figure 8 were derived by 1) connecting lines between each park and the nearest adjacent parks, 2) bisecting these connecting lines at 90°, and 3) connecting the bisecting lines to form a theoretical service area for each park. Unit areas of this type provide a base map for plotting residuals and also allow a visual analysis of the spacing of parks. The larger the unit area, the more scattered the parks.

by the camping populace. Only in two cases were camper "turn aways" evident at these parks in 1964.[14]

For four of the Upper Peninsula parks the attraction indices relative to camper-days may truly indicate "undiscovered" horizons for camping. Porcupine Mountains and Muskallonge, fairly remote from major highways, have a wilderness character and their isolation is probably partially influential in the overprediction, particularly for Porcupine Mountains with a relatively high attraction index of 117. Gogebic and Van Riper are relatively near major highways, both are attractive parks with an index of 113 for Gogebic and 129 for Van Riper.

There is no apparent reasonable explanation for the overprediction of Grand Haven. This park is one of the smallest (forty-three acres) but consists of an excellent sand beach on Lake Michigan. The attraction index, 133, reflects the qualities of the park. If the overprediction of camper-days is considered an indication of true demand for camping at this park, that indication can be substantiated by the fact that camper "turn aways" at Grand Haven in 1964 totalled 16,120 camping parties.

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[14]Brighton had 580 camping parties refused admittance and Aloha 6,470. This data is recorded annually by the Parks Section of the Michigan Department of Conservation.

Summary

Factor analysis has been used for grouping park characteristics into four explanatory factors reflecting the recreational resources available in the Michigan State Park System. Each of the four factors--inland lakes, scenic or land resources, camping amenities, and Great Lakes--include variables of natural resources and facilities and services, two of the three elements considered paramount for a good recreation area.

A camping attraction index for each Michigan State Park is developed by combining weighted factor loadings of the variables into one overall factor score for each park. These are combined with a park's activity opportunity score, the third element essential to a recreation area. After standardization, this combination constitutes the camping attraction index and is assumed to be a measure of each park's camping attraction as well as a measure of the value of the camping experience.

The appropriateness of the index as a substitute for camping attendance is suggested by a regression analysis. By mapping the residuals from the regression, it is evident that the attraction index for a few parks is not coincident with camping attendance.

The attraction index in itself does not include a measure of the spatial situation of the parks. The index includes specific on-site characteristics, but does not include a value reflecting the relative location of parks with respect to other outdoor recreational and tourism attractions. Further analysis would be necessary to include a measure of this kind. The degree to which this shortcoming detracts from the index cannot be known until the index is utilized as a component within a travel model. Results at this point, however, show the attraction indices as sufficiently valid for use as a component in the interaction model.

CHAPTER V

EMPIRICAL VERIFICATION OF THE RECREATIONAL TRAVEL MODEL

Although the components necessary for an interaction model have already been identified, determining the parameters of these components is difficult primarily because of the absence of necessary data on recreational travel flows to Michigan State Parks. Using available data sources, the initial parameters of the interaction components are derived according to the probabilistic method discussed by Isard.[1] The following portion of this chapter is devoted to the empirical verification of the recreational travel model.

Estimating the Parameters - Camper Population

An estimate of Michigan's annual camping population can be obtained from the National Recreation Survey,[2]

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[1]Walter Isard, Methods of Regional Analysis, An Introduction to Regional Science (New York: John Wiley & Sons, Inc., 1960), p. 494.

[2]ORRRC Report 19, op. cit., p. 126.

which gives the percentage of persons twelve years or over who participate in camping in the North Central Region. These participation rates are listed by various socio-economic characteristics and by place of residence, both within and outside of Standard Metropolitan Statistical Areas (S.M.S.A.).[3] The percentages by place of residence are applied to the 1960 Census of Population[4] for each Michigan county to obtain an estimate of the annual camping population within Michigan. Using this method, P, the annual camping population within Michigan, is equal to 523,815. County camping estimates for Michigan are listed in Appendix D, Table 19.

Given an estimate of the annual camping population in Michigan, the number of trips, T, generated by the camping population is estimated by dividing P by the average number of persons per camping party in the park system in 1962.[5]

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[3]The percentage figures for the North Central Region are as follows: Residence in an S.M.S.A.--Urban (over 1,000,000-Wayne County only), 6%, Urban (under 1,000,000), 5%, Rural, 14%; Residence in Non-S.M.S.A.--Urban, 12%, Rural Farm, 4%, Rural Non-farm, 3%. ORRRC Report 19, ibid., p. 126.

[4]U.S., Bureau of the Census, Eighteenth Census of the United States: 1960. Population, I (Part XXIV, Michigan), p. 14.

[5]Michigan, Department of Conservation, Parks and Recreation Division, Summary Camping Information (Lansing, Mich., 1962), p. 3. (Mimeographed.)

$T = \frac{523,815}{4.25} = 123,250,$[6] where T is the number of trips. Since no information is currently available on the total number of annual camping trips in Michigan, this method for estimating T appears to be the most satisfactory alternative. Conceivably, the number of camping permits in the Michigan State Park system could have been used as an estimate of T, but extensions of camping permits, averaging 33 per cent annually, would have resulted in an overestimation of actual camping trips in the state. No information was available at the time T was estimated on camping trips to state or national forests within Michigan.

Following the probabilistic method of Isard, the next step in developing the interaction model is to establish the friction of distance at zero. This procedure requires an estimate of the number of camping trips originating in one county of Michigan and terminating in a state park. Hence it is necessary to utilize the

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[6]The total number of camping permits issued in Michigan State Parks in 1962 was 188,276. Sixty-seven per cent of these, or 126,955, were to Michigan residents. This would indicate that the difference between estimated camping trips by Michigan residents is fairly close to the actual in 1962, particularly if it is assumed that 33 per cent of the total permits issued each year are for extended stays (extensions) in the same park.

attraction indices for state parks. For example, suppose an individual in a Michigan county, P_i, were to go camping. The probability that he would go to Wilson State Park, represented here by its attraction index (101.1) and designated A_j, is equal to the ratio A_j/P, the empirically derived attraction index for Wilson State Park divided by the total camping population of the state. Thus, the probability of a camper traveling to Wilson State Park is $A_j/P = \frac{10,110}{523,815} = .019$ or 1.9 per cent. (The attraction index has been multiplied by 100 for convenience in the example.)

Since any camper in the state, under the hypothetical assumptions here, is identical with any other camper in Michigan and the friction of distance is zero, it appears permissible to estimate the number of camping trips any individual makes as the average number of trips per capita for Michigan. Such an average is T/P, or $\frac{123,250}{523,815} = .24$, and is designated k. By using k, one can now estimate the absolute number of camping trips a camper in Michigan can be expected to make to Wilson State Park, $k(A_j/P) = .24\ (\frac{10,110}{523,815}) = .24\ (.019) = .00456$ or .45% (probability) This indicates that if 1.9 per cent of all camping trips in Michigan are made to Wilson State Park

and the average number of camping trips per capita are .24, then each camper in Michigan could be expected to make less than one visit to Wilson State Park. This applies, however, to any camper in Michigan. It does not tell how campers in specific Michigan counties might be inclined to travel to Wilson State Park.

To estimate the number of campers from an individual county--for instance Wayne County--to Wilson State Park, the estimated number of campers in Wayne County, designated P_w, must be known. P_w here is equal to 165,337 (Table 19, Appendix D). Now,

$$T_{jw} = k \frac{A_j P_w}{P} = .24 \frac{(10,110)\ (165,337)}{523,815} = 766, \quad (1)$$

where T_{jw} identifies the total number of camping trips by Wayne County campers to Wilson State Park.[7] Such hypothetical camping trip volumes can similarly be derived for all counties and parks in Michigan. Before

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[7]This figure is very close to the actual number of camping permits issued to campers originating in Wayne County. In 1962 there were 694 permits issued in Wilson State Park to camping parties from Wayne County and in 1964 there were 664 permits. Both figures include extensions. The 1962 figure was obtained from Michigan State Highway Department, Origin Survey of Campers at Michigan State Parks, 1962 (Lansing, Mich., 1963), p. 28. (Mimeographed.) The 1964 figure was obtained from the Michigan Outdoor Recreation Demand Study.

this is done on a sample basis, a new variable, the distance function, is added in the model.

Estimating G - Constant and Distance Exponent

Until now, the friction of distance has been assumed to be zero. In reality this is not so. Estimated time-distances now make it possible to measure the effect of time-distance between origin counties and parks in terms of the number of hypothetical trips originating and terminating. Since actual data on the number of trips between counties and parks are not available, the number of camping permits is used to estimate traffic volume. A recent survey includes the number of permits issued to campers from Michigan counties in the twenty-five parks having the highest number of camping permits.[8] A sample of actual trips by Michigan campers is drawn from this survey. By utilizing the camping permit figures for counties listed at

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[8] Origin Survey of Campers, op. cit., p. 4. At least three counties were listed for each of the twenty-five parks. The following counties were among those listed: Wayne, Oakland, Genesee, Kent, Ingham, Macomb, Saginaw, Bay, Muskegon, Midland, Kalamazoo, Montcalm, and Ottawa.

each of the twenty-five parks, 107 origin and destination links for Michigan are obtained.[9]

The number of camp permits between an originating county and a state park, used here as actual trip volume, are designated I_{ij}. Actual trips are divided by the expected or theoretical trip volume (T_{ij}) to obtain a ratio of actual to theoretical trips, I_{ij}/T_{ij}. To compute T_{ij} for each of the 107 sample links, equation (1) was programmed.[10] There are 766 theoretical trips, T_{ij}, to Wilson State Park from Wayne County, while the 1962 figure was 694. The ratio of actual to theoretical trips for this link is I_{ij}/T_{ij} or 694/766 = .9061. Following Isard's method, the ratio of expected trips to theoretical trips is plotted on a graph with a logarithmic[11] scale on the Y axis (dependent variable),

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[9]There are several limitations to the use of this data as a sample, but it was the only data available. The number of camping trips are preferable to camping permits. In addition, none of the twenty-five parks in the survey were state recreation areas located near metropolitan areas in the southern one-half of the state. Since state recreation areas where camping is allowed are used in this model, this deletion in the state survey is unfortunate.

[10]PARKATTR was written for the author by Charles Hart of Michigan State University.

[11]A logarithmic transformation is used to reduce the problem of dealing with extreme cases and to improve linearity.

and the log of the time-distance variable td_{ij} on the X axis (independent variable). A least squares regression analysis of these variables is calculated.[12] The equation for the line is

$$\log \frac{I_{ij}}{T_{ij}} = a-b \log td_{ij}. \qquad (2)$$

In this equation a is a constant which is the intercept of the straight line with the Y axis. The constant b defines the slope of the line. If the logs are removed from equation (2) and c is used for the antilog of a, the intercept is $\frac{I_{ij}}{T_{ij}} = \frac{c}{td_{ij}^{b}}$ or

$$I_{ij} = \frac{cT_{ij}}{td_{ij}^{b}}. \qquad (3)$$

By replacing the value of T_{ij} in equation (3) with the value of T_{iw} in equation (1) and setting the constant G equation to ck/P, a basic gravity or interaction model is obtained.

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[12]The DAP-2 program was used. This program was written by James Clark of the Department of Psychology, Michigan State University. DAP-2 forms scatter diagrams of pairs of variables plotted on standard score axes in 1/4 standard deviation categories. In addition, it prints out the mean, standard deviation, and variance of each variable, covariance, product moment correlation, regression coefficients, slope By,x and intercept, Ay,x. In the equation a = 5.67 and b = -.97.

$$I_{ij} = G \frac{A_j P_i}{td_{ij}^{b}} . \qquad (4)$$

Using the regression coefficients and the previously estimated values for k and P, the following values are obtained for the model: c, the antilog of a in equation (2), equals 4.9, k = .24, and P = 523,815; therefore

$$G = ck/P = 4.9 \times .24/523{,}815 = .000002245.$$

The slope b is equal to the exponent for td, the time-distance between parks and counties. In this case b is equal to -.97 or -1.0. Therefore, the following formula is used to predict the actual trip volumes between seventy-one origin counties and fifty-nine Michigan State Parks where camping is allowed:

$$I_{ij} = (.000002245)\left(\frac{A_j P_i}{td_{ij}^{1.0}}\right) . \qquad (5)$$

However, since it is necessary to predict the movement of campers to a park from all seventy-one counties, the model will have to predict movements from county P_1, plus county P_2, to . . . county P_{71} or $I_{1j} + I_{2j} + \ldots I_{71j}$. Therefore, equation (4) becomes

$$\sum_{i=1}^{71} I_{71j} = (.000002245)(A_j)\left(\sum_{i=1}^{71} \frac{P_i}{td_{71j}^{1.0}}\right). \quad (6)$$

When the time-distance variable was estimated, seventeen out-of-state origins were also measured. Obviously, not all campers in Michigan State Parks are from Michigan; in 1962, 67 per cent of the campers were. The percentages of campers in Michigan parks from the surrounding states[13] are as follows:

Ohio	7.6%
Illinois	6.2
Indiana	5.4
Wisconsin	3.1
Minnesota	1.8.

Selection of Standard Metropolitan Statistical Areas (S.M.S.A.) as origins in the above states is based on the premise that most of the campers will come from the largest population centers in these states[14] and from those S.M.S.A.'s that are closest to Michigan. A majority of these origins are within 150 miles of the Michigan boundary.

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[13]Summary of Camping Information, op. cit., p. 3.

[14]This premise is true for Michigan campers. Thirty-four per cent of the campers at the twenty-five parks used in the Origin Survey of Campers had come from the three largest metropolitan counties of Wayne, Oakland, and Macomb. These counties contained 48 per cent of Michigan's population in 1960. Origin Survey, op. cit., p. iii.

The 1962 survey[15] did not contain the number of camp permits by individual counties or S.M.S.A.'s within the surrounding five states, but listed total permits from each state. To estimate G and the exponent by the same probability method used for Michigan origins and including out-of-state origins, a weighted time-distance figure was devised for each of the five states. The weights are the estimated camper population within each S.M.S.A. Using these weights for each of the sample parks, the number of sample origins for estimating G and the exponent are increased from 107 to 186. The DAP-2 Program yields a regression equation with $\underline{a} = 14.8$ and $\underline{b} = -1.4$. Using this data, equations (2), (3), and (4) are computed with

$$G = ck/P = 14.8 \times .24/1{,}366{,}933 = .000002598$$

and the exponent equal to -1.40. Hence the interaction model including seventeen out-of-state S.M.S.A.'s becomes

$$\sum_{i=1}^{88} I_{88j} = (.000002598)(A_j)\left(\sum_{i=1}^{88} \frac{P_i}{td_{ij}^{1.4}}\right). \quad (7)$$

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[15] Ibid.

Verification of Time-Distance Exponent

One major problem in the application of an interaction model to a specific problem is the selection of the empirically derived exponential function for distance. Two exponents, -1.00 and -1.40, have been derived at this point; the latter one, including the seventeen out-of-state origins, should be used.[16]

How do these exponents compare with empirical studies of other trip types?[17] The exponent for travel-time

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[16]In the Crevo model, mentioned in Chapter II, theoretical trips were predicted in a manner similar to equation (1); however, an attraction index was not used. The ratio of theoretical trips to actual trips was obtained and plotted against travel time in minutes, with both variables converted to logarithms. The results of this analysis produced exponents of -0.81 and -1.3, an indication that the estimates computed for this model are probably valid. Crevo, op. cit., p. 51. In the Connecticut study, however, the longest trip was ninety-five minutes, while in this study some trips are more than fourteen hours. A major shortcoming of the gravity or interaction model is that it frequently loses its validity over long or unlimited distances. It is successfully used for predicting intracity movement, but it has only been reasonably successful for intercity travel predictions. John T. Lynch, Glenn E. Brokke, Alan M. Voorhees, and Morton Schneider, "Panel Discussion on Inter-Area Travel Formulas," Traffic Origin-and-Destination Studies, Bulletin 253 (Washington: Highway Research Board, 1960), p. 128.

[17]For intracity trips, where travel time is frequently used as a function of distance, an exponent of 1.5 for total trips is common. Exponents for total travel between cities of 2.5 are numerous; unfortunately, the parameters for intracity and intercity travel are different. The latter is usually based on airline distance. U.S., Department of Commerce, op. cit., pp. ii-3.

varies by trip purpose--work trips have a lower exponent than social-recreation trips.[18] Examples of exponents for specific trip types in urban areas are school trips, 2.0+; shopping trips, 2.0; social trips, 1.1; and work trips, 0.9.[19] This suggests that distance becomes a less restrictive factor as trips become more important. A camping trip, unlike a work trip, is infrequent, but the very infrequency of such a trip increases its importance. Intuitively it seems that camping parties are willing to travel long distances or periods of time to reach an attractive park for camping. Therefore, the relatively low exponents that have been derived appear valid for application in the model.

Results and Analysis of Model Solutions

The parameters used in the first interaction model[20] are those discussed in the preceding chapters and listed below:

1. The attraction index without the adjustment for capacity, i.e., the campsite ratio.

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[18]Ibid., p. II-7.

[19]Walter G. Hansen, "How Accessibility Shapes Land Use," Journal of the American Institute of Planners, Vol. XXV (May, 1959), p. 74.

[20]The program INTERACT 1, an interaction model, was written for the author by Charles Hart, Michigan State University.

2. The estimated number of camper-days[21] from each origin area.

3. The time-distance links between the fifty-nine parks and eighty-eight origin nodes.

4. The exponent of -1.40 derived by the least squares method.

All of these parameters, with the exception of time-distance, are varied in successive applications of the model in order to achieve the best simulation of 1964 camper-day attendance at each park. A second goal is to match the 1964 camper-day figures from each of the eighty-eight origins. The successful simulation of these figures, however, does not insure that the model correctly predicts flows from each of the origins to one particular park, or from one origin to each of the fifty-nine parks. A separate statistical analysis of one county is done for a number of solutions to measure accuracy of the model in this respect.

The basic measure used to compare various model

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[21]A camper-day is one person camping one night. An estimate of camper-days at each origin was computed concurrently with estimates of the number of campers. This estimate was also derived from information in the National Recreation Survey. For the North Central Region, the number of camping activity days per participant is listed as 3.7 for campers in Non-S.M.S.A. counties and 6.1 for campers in an S.M.S.A. These figures were multiplied by the estimated number of campers in each origin for an approximation of camper-days (see Appendix D, Table 19).

solutions is the root-mean-square error[22] (r.m.s.) of the predicted total camper-days at parks and at origins. The root-mean-square error for parks is

$$\text{Parks r.m.s. error} = \sqrt{\frac{1}{59} \sum_{j=1}^{59} (\text{per cent of error of park } j)^2}$$

and for origins

$$\text{Origins r.m.s. error} = \sqrt{\frac{1}{88} \sum_{i=1}^{88} (\text{per cent error of origin } i)^2} \; .$$

The per cent error is defined as follows:

$$\text{Per cent error of park (or origin) camper-days} = \frac{\text{predicted camper-days at park (or origin)} - \text{actual 1964 camper-days at park (or origin)}}{\text{actual 1964 camper-days at park (or origin)}} \times 100.$$

The 1964 origins and destinations of Michigan State Park campers are available from the Michigan Outdoor Recreation Demand Study. For parks, two additional measures are arbitrarily used to quickly judge poor results.

1. The number of parks with a camper-day percentage error equal or less than 20.

2. The number of parks with a camper-day percentage error equal or greater than 50.

The ultimate success of this model is dependent upon its ability to simulate the system. The goal,

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[22]The root-mean-square error is defined as the square root of the averaged sum of the squared percentage difference between predicted and actual camper-days.

therefore, is to achieve the lowest r.m.s. predictive measure feasible. In a behavioral system such as this, an r.m.s. measure of plus or minus 20 per cent for parks and origins is chosen as an acceptable range.

Analysis of Basic Model One

Description

G = .000002598	Attraction Index - Without Campsite Ratio
Exponent = 1.4	Origin Populations - Estimated Camper-days

The basic model did not produce a successful simulation of actual attendances. Test measures on this run resulted in an r.m.s. error of 403.5 for parks and an r.m.s. for origins of 318.9 (Table 13). Fifty-four per cent of the fifty-nine parks had over or underpredicted camper-days by more than 50 per cent, while twelve parks were equal to or less than 20 per cent of the 1964 attendance.

A detailed examination of results of this model revealed areas for improvement. Since the model had obviously under or overpredicted camper-days for some parks, consistency, in terms of actual 1964 attendance, was checked. Did parks with low attendance have low predictions, or was the reverse true? Finally, the attraction indices were studied to discover if the model had predicted according to the magnitude of the indices.

TABLE 13.--Error measures for select interact models

Model Number	R.M.S. Error		Number of Parks		Exponent Used
	Parks	Origins	≤20%	≥50%	
1	403.5	318.9	12	32	1.4
2	59.7	456.1	16	18	1.4
3	77.6	110.1	14	24	1.4
4	56.4	125.8	21	15	1.0
5	75.0	51.6	12	25	1.4
6	55.4	43.0	19	16	1.0
7	42.4	37.2	26	12	.4

All but three of the twelve parks having a prediction of 20 per cent or less of attendance, had very low 1964 actual attendance. Three of the parks, Grand Haven, Waterloo, and Yankee Springs, had very high 1964 attendance (Figure 2). An inspection of the attraction indices of the twelve parks indicated that none of the parks had either very high or very low indices, with a range from 43 for Algonac to 109 for Yankee Springs. All twelve parks were scattered over the state.

Twenty-two parks overpredicted by more than 20 per cent and eleven of these are state recreation areas located in the Detroit Metropolitan Region. The attraction indices of these twenty-two parks ranged from 46 for Cheboygan to 140 for Muskegon.

Camper-day attendance at twenty-five parks that were underpredicted included eight parks in the Upper Peninsula. The seventeen lower peninsula parks are concentrated in the northern one-half of the peninsula, with the exception of East Tawas and Lakeport, while a majority of the parks are located on Lake Michigan--from the Straits of Mackinac south to Silver Lake State Park in Oceana County. Several parks are located within fifty miles of the Great Lakes. Two parks, Higgins Lake and Otsego, are further inland and located adjacent to Interstate 75. Ten of the twenty-five parks had relatively high camper-day totals in 1964, which may have influenced their being underpredicted. But seven of these ten parks have attraction indices of 95 or higher, and two, Ludington and Silver Lake, have very high indices of 163 and 132 respectively.

Several generalizations appear from this analysis. Parks that are overpredicted are those located very close to centers of population, and frequently are clustered, as for example the state recreation areas in southeastern Michigan. There appears to be a consistent overprediction of camper-days for the first and sometimes the second park on the route campers travel over out of a metropolitan area. For instance, attendance at Muskegon State Park is overpredicted, while that of the next park north from Muskegon, Silver Lake, is underpredicted. Another example of an overpredicted park attendance is Warren Dunes, the first Michigan park to be reached by residents of Gary, Hammond, South Bend, and Chicago. That the model is overpredicting to the first or second park and not beyond is substantiated by overpredicted camper-days in such relatively unattractive parks as Gladwin and White Cloud by more than 190 per cent. In the case of Gladwin, the nearest population centers are Midland and Bay City; campers at Bay City State Park, four miles north of Bay City, also are overpredicted. The next park north of Gladwin, Wilson, is within the 20 per cent acceptable range, while Higgins Lake, 30 miles north of Wilson, with a very high attraction index, is underpredicted by 76 per cent. Since most of the parks that are underpredicted are in the northern one-half of the state, the first conclusion is that the attraction indices as used in the model are not adequately weighted. A second conclusion is that the exponential value does not adequately reflect long distance accessibility.

Revision of Attraction Index

A re-evaluation of the attraction index resulted in the decision to include a camping-capacity weight as a part of the index. This revision was discussed in Chapter IV. Each park's attraction index is multiplied by the ratio of the number of campsites in the park to the average number of campsites (181) in all fifty-nine parks. For example, Bald Mountain State Recreation Area has an index of 50.8. In Model One camper-days for this park are overpredicted by more than 999.9 per cent. By multiplying the original index for Bald Mountain by the campsite ratio (40/181 = .22), the index is lowered to 11.2. Before the attraction index with the campsite ratio is utilized, two other modifications are necessary.

Addition of Terminal Time

Since the parks closest to the centers of the origin populations are overpredicting in Model One, the distance component is also seemingly in error. Previous research with gravity models has shown that for intercity travel, where trips are long, the omission of a terminal time was not important. For intracity travel, however, where travel times are short, neglecting this factor had a considerable affect.[23] Due to the range in travel times within the model, from less than one hour to fourteen hours, it is concluded that the addition of a terminal time of one hour to each time-distance link might decrease the number of short trips but have little affect on trips of long duration. In particular, such a refinement may reduce short trips from metropolitan centers to nearby parks such as state recreation areas.[24] The addition of a terminal time in a model such as this appears justified no matter how long the trip, a camping trip of any length requires a terminal time to set up camp at the site.

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[23]U.S., Dept. of Commerce, Calibrating and Testing a Gravity Model, op. cit., p. II-4.

[24]The model was solved with the addition of terminal time but without the attraction index with the campsite ratio. This run produced an r.m.s. error for parks of 143.0 and for origins of 232.3, a definite improvement from Model One. Predictions at individual parks were substantially improved. Bald Mountain, which has overpredicted on Model One by more than 999.9 per cent, was overpredicted by 360 per cent. Brighton dropped from +257 per cent on Model One to +44 per cent. Both state recreation areas are located near the Detroit Metropolitan Area.

Adjustment Ratio

Total annual camper-day predictions on Model One were 3,256,226, whereas actual camper-days in 1964 were 3,136,977. The difference between these two totals is negligible.[25] But to assure more accurate predictions of total camper-days for Michigan and for each park, a new ratio is incorporated within the model. Camper-day predictions are made and are adjusted up or down to bring them in line with the actual 1964 totals according to the ratio

$$\frac{\text{Actual 1964 Camper-Days (3,136,977)}}{\text{Total Predicted Camper-Days}} .$$

Analysis of Model Two

Description

G = .0002598	Attraction Index - With Campsite Ratio
Exponent = 1.40	Origin Populations - Estimated Camper-days
One Hour Terminal Time	Adjustment Ratio Used - Total = 3,136,977

Model Two introduces three modifications: the campsite ratio as a part of the attraction index, the

[25]The difference between the actual 1964 total and the predicted total on Model One is negligible, but when the model was run with the one hour terminal time, the difference was substantial, 3,136,977 to 1,709,334.

one hour terminal time to each time-distance link, and the total camper-day adjustment ratio. The results, after including these modifications, were gratifying. Now the r.m.s. error for parks was 59.7; for origins it was 456.1. Camper-day attendance predictions at individual parks are substantially improved. Sixteen parks are now predicted equal to or less than 20 per cent of their actual 1964 attendance while eight parks are off by more than 50 per cent (Table 13).

Improving the prediction of camper-days from origins began with examination of the origin output on Model Two, which indicated that predicted out-of-state origins were especially high.[26] Origin predictions for Michigan counties were also inaccurate, but less so than out-of-state origin predictions. As an example, Model Two predicted 751,974 camper-days from Chicago while the estimated camper-days from the National Recreation Survey[27]

[26]The r.m.s. error for origins was enough indication that the model was not predicting origins accurately; however, some other measures were also available. The program computed the mean and standard deviations of total predictions for parks and origins. The mean number of camper-days for the eighty-eight estimated origins was 26,587 while the predicted mean was 35,647. The standard deviation of estimated camper-days was 68,175 and the predicted standard deviation was 103,482.

[27]ORRRC Report 19, *op. cit.*, p. 126.

were 35,665. Actually there were only 135,269 camper-days from the entire State of Illinois in 1964.[28] The necessity to scale down the estimates of camper-days for out-of-state origins is apparent.

Revised estimates of annual camper-days for all out-of-state origins are calculated by allocating a proportion of the actual 1962 percentage of camper-days for each state among selected origins for that state. For example, there were 2,723,766 camper-days in the entire Michigan State Park system in 1962, and 5.1 per cent of these were from Illinois, or 138,912 camper-days. Originally the total number of camper-days estimated for Chicago was 2,428,605 (Table 19, Appendix D). Assuming that only 5.1 per cent of these camper-days take place in Michigan, then an estimated 123,615 camper-days from Chicago (.0509 x 2,428,605) could be expected in Michigan. Camper-days are estimated in a similar manner for the three remaining Illinois origins. This reapportionment results in a total of 138,639 camper-days from Illinois. Camper-days from S.M.S.A. origins in Indiana,

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[28]The Illinois total of camper-days was obtained from the Parks Section of the Michigan Department of Conservation. State totals of this type are tabulated annually but not by specific origin within a state.

Wisconsin, Ohio, and Minnesota are estimated by the same method. These revised figures are listed in Table 19 of Appendix D.

By using this method the total estimated camper-days from all in-state and out-of-state origins are reduced from the original estimate of 8,013,794 to 3,113,765. The latter is obviously closer to 1964 actual camper-days in the Michigan State Park system. The revised out-of-state origin estimates are used in Models Three and Four.

Analysis of Models Three and Four
Revised Out-of-State Origin Estimates

Description

G = .000002598	Attraction Index - With Campsite Ratio
One Hour Terminal Time	Origin Populations - Out-of-State Revised
	Adjustment Ratio Used - Total 3,136,977
Model Three - Exponent = 1.40	Model Four - Exponent = 1.00

A revision of estimated camper-days for out-of-state origins substantially improved the accuracy in predicting camper-day origins. Whereas Model Two had an r.m.s. error of 447.8 for origins, Model Three resulted in an r.m.s. of 110.1 for origins. With the new origin data, the predicted r.m.s. value for parks on Model Three, 77.6, was worse than the 59.7 on Model Two.

A fourth model utilizing the lower of the two derived exponents was then attempted. The lower exponent was derived by using a sample of Michigan origins. Using the 1.00 exponent on Model Four, the r.m.s. error for parks of 56.4 is the best achieved to this point. The origin r.m.s. value is 125.8, worse than on Model Three (110.1), but still much better than that obtained on Models One and Two. In addition to the relatively low r.m.s. for parks, there were more parks, twenty-one, with predictions of 20 per cent or less than there had been on previous models. Only fifteen parks were off by more than 50 per cent.

The improved results attained on Model Four by using a lower exponent cannot be fully explained. Perhaps time-distance is not prohibitive to the camper when he selects a park, and conceivably the park itself, if sufficiently attractive, can pull campers from long distances. It is apparent that more knowledge is needed about travel preferences and the behavior of campers.

Although Model Four is reasonably successful and justifies the utility of an interaction model to predict attendance at each Michigan State Park, it is not

yielding a simulation of the system satisfactory for planning purposes. Both r.m.s. measures for parks and origins are too high, particularly that for origins. To improve the model, the known origin components are used as input. Estimates of camper-days at each of the eighty-eight origins have been used in the model to this point. There are several reasons for this. If the model is to be of practical value for planning purposes, it should require a minimum of actual data. For this reason estimates of camper-days by origins were calculated with data from the National Recreation Survey[29] in an attempt not only to bypass the need for actual figures, but also to test the validity of utilizing component estimates based on this source.

An analysis of predicted camper-days at each origin on Model Four indicates that Wayne County predictions of 1,013,382 were more than double (98 per cent) the actual 1964 attendance of 512,000. Chicago predictions of 84,876 were also more than double the estimated 1964 attendance of 35,665. These results suggest that the estimated camper-days at each origin are not realistic, assuming the attraction index was correct. In the

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[29]ORRRC Report 19, op. cit.

remaining models, the actual 1964 camper-days from each of the eighty-eight origins are used in lieu of the estimated camper-days (see Appendix D, Table 19).

Analysis of Models Five and Six
Origins - 1964 Camper-Days

Description

G = .000002598	Attraction Index - With Campsite Ratio
One Hour Terminal Time	Origin Populations - 1964 Data Adjustment Ratio Used - Total 3,136,977
Model Five - Exponent = 1.40	Model Six Exponent = 1.00

By using a known component in the model, the predictions of camper-days from origins are substantially improved. The r.m.s. error for origins on Model Five is 51.6. Predictions are also improved from specific origins--for example, total camper-days from Wayne County are overpredicted by 28 per cent while Chicago is underpredicted by 31 per cent.

Improvement in the ability of the model to predict camper-day origins is not reflected in the capability of the model for predicting attendance at parks. On Model Five, the r.m.s. error for parks is 75.0 with only twelve parks within 20 per cent of the actual 1964 attendance, and twenty-five parks are off by more than

50 per cent (Table 13). While the origin predictions are approaching acceptability, the attendance predictions at parks are becoming worse. Model Six is identical to Model Five with the exception of the distance exponent.

The solutions on Model Four, with an exponent of 1.00, prompted experimentation on Model Six with the same exponent. On Model Six an r.m.s. error of 55.4 is the best achieved to this point. Nineteen parks are within 20 per cent of actual camper-days and sixteen parks are more than 50 per cent from the actual value. The r.m.s. error measure of origin predictions is 43.0, also the best obtained.

Although Model Six produces attendance predictions with the lowest r.m.s. error at origins and destinations, analysis shows that the distribution of camper-days from an individual county to each of the fifty-nine parks is not close to reality. The model is inadequate for predictions of this detail. For example, when predictions for Wayne County camper-days at each of the fifty-nine parks are compared with the 1964 figures and the r.m.s. error is computed, the error for all fifty-nine parks is 489. The model overpredicted camper-days from Wayne County for a majority of state recreation areas and for popular parks such as Grand Haven and Holland. The histogram in Figure 9 provides a visual analysis of the actual 1964 camper-days from Wayne County by time-distance zones.

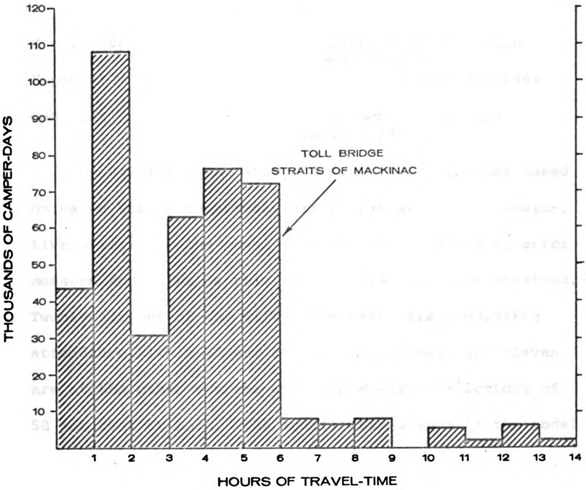
Wayne County was selected above because it has the largest camper-day populace of any origin node utilized in the model. The 512,000 camper-days from this county amounted to one-sixth of all camper-days in Michigan State Parks in 1964. A regression analysis of 1964 camper-days from the county was computed using the DAP-2 Program. When the logarithms of camper-days at each park are placed on the Y axis and the log of the time-distance between Wayne County and each park on the X axis, the result is a regression line with a slope of -.40. Thus a new exponent is available for testing the model.

Theoretically the new exponent is valid for use in the model. The two previously used exponents were derived from a sample of 1962 camper permits, whereas this exponent is based on 1964 camper-days from the primary origin node in the state's park system. Foregoing runs of the model indicate that the lower of the two

FIGURE 9

CAMPER-DAYS

BY HOURLY INCREMENTS TO MICHIGAN STATE PARKS FROM WAYNE COUNTY, MICHIGAN 1964



exponents produce the best solutions. The new value provides an even lower exponential function for improving the model.

Analysis of Model Seven
Adjustment Ratio - 3,136,977
Exponent = .40

Description

G = .000002598	Attraction Index - With Campsite Ratio
Exponent = .40	Origin Populations - 1964 Data
One Hour Terminal Time	Adjustment Ratio Used Total 3,136,977

By utilizing the empirically derived exponent based on Wayne County camper-day travel patterns, the predictive ability of the model is improved. The r.m.s. error measure for parks on this run is 42.4, the best obtained.[30] Twenty-six out of the fifty-nine parks are predicting attendance within 20 per cent of the actual, and eleven are at the other extreme with camper-day predictions of 50 per cent or more. The modifications made in the model for this run are justified in terms of the increased accuracy attained in predicting origin camper-days. An r.m.s. error of 37.2 was obtained for origins.

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[30]A regression analysis of the relationship between projected camper-days and actual camper-days on Model Seven produced an r^2 of 0.82.

In addition to standard tests of the model, predicted attendance at each park from Wayne County are examined. The r.m.s. error of these predictions is totally unacceptable at 369.0. The model is now approaching acceptable solutions for prediction at each of the fifty-nine parks from eighty-eight origins, but for detailed predictions from individual counties to each park, it is inadequate.

Summary of Model Runs

In successive runs of the model all components have been adjusted or revised with the exception of the time-distance links. Three exponents have been utilized with the one of lowest magnitude yielding the best solution. The most complete camper-day data at origins is included. A logical revision of the attraction indices, which included a camping capacity measure at each park, was inserted at a beginning stage. With these adjustment and revisions in the model, it is assumed that a great deal of "noise" has been eliminated.

In a behavioral system of the type simulated in this model, r.m.s. measures of 20 per cent or less were arbitrarily considered as a successful simulation of the system. Such a measure has not been attained for

park predictions here and it is doubtful that such an arbitrary limit can be achieved without completely revising the attraction indices. Assuming that better predictions at parks could be obtained by revising the attraction indices, then the model can be of some use for planning purposes.

The functional capability of the model, demonstrated by Model Seven, can be evaluated further by assessment of annual attendance fluctuations at individual parks. Between 1963 and 1964, overall camper-day attendance at fifty-nine Michigan State Parks increased by 8 per cent, but changes at specific parks vary. Some parks had camper-day increases of more than 100 per cent while others decreased by more than 40 per cent. A root-mean-square measure of the percentage change in attendance at the fifty-five parks between 1963 and 1964 is 33.4 per cent. From 1962 to 1963, the r.m.s. error is 28.7 per cent.[31] It is apparent that from year-to-year camper-days at individual parks fluctuate considerably. This model has been developed to simulate attendances for one year. Recognizing the actual year to year fluctuations at parks, the 42.4 per cent r.m.s. on Model Seven,

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[31]Ellis, op. cit., p. 32.

although not as desirable as a lower figure, may not be excessive.

Presuming that the attraction indices are at fault in the model, a supplementary analysis of some of the worst solutions (50 per cent or more) on Model Seven should assist in establishing which park indices are in error as well as the type of revision necessary. Predicted attendances from Model Seven are listed on Table 14.

Four of the most poorly predicted attendances--of the eleven parks with attendance projections of 50 per cent or more--are, in order of decreasing per cent error, Muskallonge (+162.5%), Bay City (+107.3%), Brighton (+98.9%), and Pontiac Lake (+74.1%). For all four parks the projected camper-days according to the model are more than would be expected. Three of these parks are the same that indicated a high negative standard error of estimate from the regression analysis in Chapter IV. These three are Muskallonge,[32] Bay City, and Brighton. The fourth park, Pontiac Lake, has one of the lowest attraction indices, 15.2, and a low 1964 camper-day attendance of 6,018.

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[32]It should be noted that attendance projections at Muskallonge State Park on all runs of the model were well above the actual 1964 attendance figures.

TABLE 14.--Predicted camper-day from Model Seven Compared to 1964 attendance

Park		Predicted Attendance (Camper-days)	Error	% Error
Algonac	1	31,962	6,538	-17.0
Aloha	2	86,622	31,773	57.9
Bald Mountain	3	7,611	1,183	18.4
Baraga	4	18,668	4,452	31.3
Bay City	5	97,297	50,366	107.3
Benzie	6	14,936	10,601	-41.5
Brighton	7	74,608	14,392	98.9
Brimley	8	39,141	31,046	-44.2
Burt Lake	9	73,104	10,631	-12.7
Cheboygan	10	4,234	388	-8.4
D.H. Day	11	23,031	5,904	-20.4
East Tawas	12	53,844	19,540	-26.6
Fayette	13	4,614	577	-11.1
Fort Wilkins	14	12,754	12,067	-48.6
Gladwin	15	9,589	2,283	31.2
Gogebic Lake	16	42,550	13,009	44.0
Grand Haven	17	78,672	1,009	1.3
Harrisville	18	45,195	14,098	-23.8
Hartwick Pines	19	10,472	11,194	-51.7
W.J. Hayes	20	74,687	5,137	-6.4
Higgins Lake	21	204,730	23,625	13.0
Highland	22	11,785	185	-1.5
P.H. Hoeft	23	23,757	2,564	12.1
Holland	24	144,450	12,162	9.2
Holly	25	67,437	26,531	64.9
Indian Lake	26	43,351	11,727	-21.3
Interlochen	27	145,776	12,294	9.2
Island Lake	28	36,736	13,838	60.4
Lakeport	29	64,631	16,294	-20.1
Ludington	30	141,533	15,494	12.3
F.J. McLain	31	9,824	12,649	-56.3
Charles Mears	32	25,770	3,067	-10.6

TABLE 14.--Contd.

Park		Predicted Attendance (Camper-days)	Error	% Error
Metamora-Headley	33	49,898	35,234	-41.6
Wm. Mitchell	34	55,125	7,278	15.2
Muskallonge Lake	35	29,525	18,278	162.5
Muskegon	36	95,587	16,392	20.7
Onaway	37	22,630	2,364	11.7
Orchard Beach	38	35,077	8,248	-19.0
Ortonville	39	11,375	3,901	52.2
Otsego Lake	40	61,847	4,984	-7.5
Pinckney	41	113,325	33,237	41.5
Pontiac Lake	42	10,479	4,461	74.1
Porcupine Mts.	43	44,149	13,026	41.9
Port Crescent	44	42,588	3,377	8.6
Proud Lake	45	44,231	27,739	-38.5
Silver Lake	46	80,030	6,177	-7.2
Sleeper	47	95,630	29,119	43.8
Straits	48	23,748	27,235	-53.4
Tahquamenon	49	58,604	6,545	12.6
Traverse City	50	69,802	14,125	-16.8
Van Riper	51	52,729	12,294	30.4
Warren Dunes	52	39,715	25,766	-39.3
Waterloo	53	107,639	16,893	-13.6
J.W. Wells	54	30,499	120	0.4
White Cloud	55	6,658	1,326	24.9
Wilderness	56	53,499	20,530	-27.7
Wilson	57	48,310	6,617	-12.0
Yankee Springs	58	96,113	15,936	-14.2
Young	59	34,791	18,283	-34.4

Unlike the other three parks, its standard error of estimate on the regression analysis was between -.5 and -1.0 S_{yc}. As a state recreation area nine miles west of the city of Pontiac, this relatively unattractive camping park is probably rated too high when considered in combination with the other model components.

Four additional parks out of the eleven also indicate overprojections of camper-days in excess of 50 per cent. These are Aloha (+58%), Holly (+65%), Island Lake (+60%), and Ortonville (+52%). Of these four only Aloha had an unusually high standard error of estimate from the regression analysis. Holly, Island Lake, and Ortonville, like Pontiac Lake, are state recreation areas in southeastern Michigan. Ortonville, like Pontiac Lake, had less than 10,000 camper-days in 1964, while Holly had 41,000 and Island Lake had 23,000. The model is obviously inadequate for projecting camper-days at the nine state recreation areas closest to the metropolitan centers of southeast Michigan. In addition to overpredictions for Brighton, Pontiac Lake, Holly, Island Lake, and Ortonville, Metamora and Proud Lake had underprojected camper-days by -42 per cent and -38 per cent respectively. Only Bald Mountain (+18%)

and Highland (+1.5%) were projecting within the critical range stated as acceptable (both have attraction indices of 17 or less).

It is believed that much of the difficulty in projecting attendance at all nine areas is due to inadequacies in the attraction indices. However, the closeness of these areas to the centers of population also suggests that the population and distance parameters may also be in error. Perhaps some camping behavioral element has been overlooked. It may be that these parks are too close for a majority of campers in southeast Michigan. It could be assumed a person in Detroit planning a camping trip would desire a park farther away than one of the state recreation areas, preferring a park that might offer more environmental contrast than that near his home.

The remaining three of the eleven parks with projections of 50 per cent or more are Hartwick Pines (-52%), McLain (-56%), and Straits (-53%). All three parks have underpredicted camper-days according to the model. Finding Straits State Park within this group is not unexpected, since it was one of the parks in the regression analysis that was in error by more than +1.0 S_{y_c}.

In Chapter IV, eight parks with S_{yc} of +1.0 or more were listed. Straits is the only one of the eight that retained an underprojection of more than -50 per cent when its attraction index was used in the model. Results from the model for the remaining eight parks are Warren Dunes (-39%), Yankee Springs (-14%), Waterloo (-14%), Algonac (-17%), East Tawas (-27%), Traverse City (-17%), and Wilderness (-28%).

All the above attendances were underprojected, but it is apparent that the addition of other components in the model bring the attendance estimate closer to reality. There are attractions adjacent to Straits State Park not included in its index.[33] For McLain State Park the underprojection of attendance can be partially attributed to the attraction index, since its S_{yc} was between 0 to +.5 in the regression analysis. Hartwick Pines' underprediction is the reverse of what could be expected from the regression analysis where it indicated

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[33]The importance of attractions external to Straits State Park and its strategic position at the Straits of Mackinac are emphasized even more by the large number (34,440) of camping parties turned away from the park in 1964. According to the Department of Conservation, one other park in the system had more turnaways. This park was Warren Dunes with a total of 45,000 parties. Warren Dunes was underpredicted by -39 per cent. Like that of Straits State Park, the location of Warren Dunes is probably the primary factor disrupting the model's projections.

an overprojection of camper-days. With origin population and distance components added to the model, its projection would suggest an attraction index higher than that computed. Located in Crawford County adjacent to Interstate 75, it is easily accessible to the population centers in southern Michigan. Hartwick Pines is also the first park north of Higgins Lake State Park, which in 1964 had a very high number of camper turnaways.[34] Campers may have driven that short distance to find available camping sites at Hartwick Pines, thus increasing camping at the less desirable park.

Refinements of the Index

In the case of Bay City State Park, near large metropolitan areas around Saginaw Bay, and the state recreation areas, overpredictions of attendance indicate the need for addition of one or more behavioral elements in the attraction indices. The missing elements, essential for proper evaluation of a park's pulling power, can only be determined by further study--preferably by field interviews to determine directly from

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[34]Turnaways at Higgins Lake for the 1964 season, according to the records of the Department of Conservation, totaled 17,430 camping parties.

participants how they evaluate a particular park for camping and how far they prefer to travel. Such an approach also will define the type of persons using the parks. Differing socio-economic characteristics of campers in the state recreation areas adjacent to the Detroit Metropolitan Area and those of campers to northern Michigan parks may account for inaccurate predictions attained for these parks in the travel model. By personal interviews it might also be found well-established parks act as a deterrent to camping in relatively new parks located nearby.

A major deficiency in the attraction index is the lack of attention to features external to each park. In addition to park site, characteristics necessary in the index must include the situation of a park, that is, nearness to other parks or recreation attractions used by campers. The deletion of this factor is an apparent failing for several Upper Michigan parks--Straits, McLain, Fort Wilkins, Brimley, Gogebic, and Porcupine Mountains--and may be a factor for other parks, particularly the state recreation areas. In addition, a more detailed analysis of origin-destination data for many of the parks might prove useful. From such data it might be determined that campers in southeastern Michigan do prefer to drive beyond the nearer state recreation areas to camp.

Although a revision of the attraction indices is not done for this study, solutions to the model strongly suggest that such a revision would substantially improve the model. Revisions should not be undertaken without personal interviewing to obtain the users' perceptions of the qualities of the parks.

CHAPTER VI

CONCLUSION

Summary

This study was initiated on the premise that a need exists for classifying and analyzing the natural resource base for outdoor recreational purposes. It was emphasized that an investigation of this type would be particularly useful in assessing feasibility of proposed recreational sites as well as in obtaining insight into the present character and value of existing sites.

The first step in the investigation was to review methods that have been utilized to measure the satisfactions derived by participants in outdoor recreational activities, recognizing that previous models (1) did not take cognizance of the resources at the site, and (2) did not specifically relate to the interaction factors that spatially connect a recreational system. The second step in the investigation was construction of an index to replicate the attractive qualities of a

state park for a particular outdoor activity--camping. This index included 1) the activity preferences of campers, 2) an assessment of the natural resources, 3) the man-made services and facilities, and 4) the capacity of each park for camping. Camping attraction as measured by the index was then compared with the attendance at parks by a regression analysis.

Finding that there was a statistically significant relationship between the index values and attendance, the attraction indices were used in an interaction travel model for the purpose of replicating the movement of campers to fifty-nine Michigan State Parks in 1964. The results of the travel model provide evidence that an empirical value of the attractive qualities of parks for one outdoor activity was successfully exhibited.[1] This success lends support to the assumptions made and methods used in constructing the index. Variations in camping attendance are dependent upon and can be partially explained by site characteristics.

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[1]For additional verification of the merits of the attraction index and its use in a systems travel model, see Jack B. Ellis and Carlton S. Van Doren, "A Comparative Evaluation of Gravity and Systems Theory Models for Statewide Recreational Traffic Flow," Journal of Regional Science, Vol. VI (Winter, 1966), p. 57.

Implications

The attraction indices used independently or as a component of a travel model have many merits. A park-by-park analysis of the recreational attributes of many points in space can be obtained by a comparison of the indices. Such an analysis has utility for obtaining a spatial overview to assist in recreation resource management studies. Sub-components of the index could be utilized in the same manner; individual attributes could be located and related spatially. For example, parks with qualities attractive for inland lake boating could be readily identified. Future research may take this course.

The primary utility of the attraction indices, however, is in travel models. Such use provides the opportunity to analyze interconnections in the existing system and to provide solutions to problems encountered when considering the location of recreational phenomena. A travel model utilizing an attraction index as a substitute for attendance allows new insights into problems of accessibility, attractiveness, competing recreational opportunities, and estimates of attendance saturation or overcrowdedness. In addition, by developing an attraction index for a proposed park based on the master plans of a state or national planning agency and the anticipated activity participation rates, the park's attendance could be simulated with an established park system. The flexibility of the attraction index and the interaction model means that necessary adjustments can be made for making demand projections of future attendance, using reliable demographic predictions and anticipated outdoor recreation participation rates. Not only can the use of new parks be anticipated but measuring benefits of planned refurbishing or enlargement of existing parks is possible. Recalling the overprediction of camping attendance at Muskallonge Park, (Chapters III and IV) the model results may be anticipating a future increase in use as the camping public discovers the park.

The model could be adapted for predictions of uses other than camping. It is conceivable that indices for predicting attendance for wilderness camping, or for other specific activities such as boating or fishing could be derived. If Factor III (camping amenities) is removed from the present index before the scoring routine is attempted and parks are weighted empirically for day-use activity preferences, then an index for day-use visitors might be constructed. At present the problem is complicated by a lack of day-use origin and destination data to verify such an index.

One of the merits of the attraction index and its use in an interaction model is that it is basically simple to construct and make operational. The simplicity of the model means that it can be duplicated for applied purposes by persons with limited analytical training. Problems in operating the model can be attributed primarily to difficulties in obtaining the necessary data inputs not only for prediction but for verification.

Even at this stage in the development of recreation travel models, when modest inputs are required, obtaining this information in the proper amount and form is difficult. Types of information difficult to obtain for this model are (1) origin and destination patterns of campers including the duration of visits, and (2) detailed characteristics of the physical environment and facilities within parks. In Michigan, origin and destination data have been potentially available from camping permits for a long time. But it was not until a specific request was made by the Michigan Outdoor Recreation Demand Study for this information[2] that its utility in two types of travel models could be demonstrated.[3] Many of the park characteristics for the attraction index were readily available, while others could be gathered from the planners and administrative staff of the Michigan Department of Conservation. Information concerning activity preferences of campers is more difficult to obtain; however, the Bureau of Outdoor Recreation has recently (September, 1965) undertaken a large nation-wide survey to amass such data. The distance component used in the model is time consuming to construct but once it is completed changes resulting from highway relocations or improvements can be easily made.

Limitations of the Model and Future Investigations

One of the limitations inherent in the model is its ability to predict only single purpose, one-way trips.

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[2]A full determination of the origins and destinations of Michigan state park camping permits for 1964 was made under the supervision of Jack B. Ellis for the Michigan Outdoor Recreation Demand Study, Department of Resource Development, Michigan State University.

[3]Ellis and Van Doren, <u>ibid</u>.

Many campers undoubtedly camp at more than one park and multiple stops for camping are not included in the model. No attempt was made in constructing the model to account for park overflows at any time during a camping season, or how a camping party may react when this occurs. To the author's knowledge, this constraint has not been applied to interaction models. It was not attempted in this investigation, since the major focus was that of testing the attraction indices.

The entire question concerning intervening opportunities in an interaction model has not been explored. The variable magnitude of the attraction indices may be minimizing the intervening effects to some extent, but this needs verification. In addition, analysis of why the model does not simulate the flows from individual counties to parks is necessary. Aggregative attendance figures are replicated but not flows from separate counties. Possibly by using several empirically derived distance exponents for selected counties, this limitation could be corrected.

The model has been verified on the basis of successful predictions for one year, but even with accurate results questions would still remain as to why the model is apparently viable in this respect. Travel behavior implications associated with the model, particularly the attraction indices, should be investigated further. Campsite interviews would reveal why campers select one park over another. Such insights into the perceptions[4] of campers will not only assist in improving models such as this one, but will eventually lead to a body of empirical data necessary for the development of hypotheses, concepts, and theories on park location. The goal in this study has not been to develop theory but to demonstrate the applicability of a recreation resource classification system in a recreation travel model.

Conclusion

This investigation has centered on a method for evaluating recreational land use at selected points in space. The development of an index of camping attraction quality demonstrates a method of area differentiation, and as a classificatory scheme not previously attempted, this attraction index provides an empirical method for

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[4]Several geographers have concerned themselves with the perceptions of the landscape. See Lucas, op. cit., p. 394, and Robert Kates, "The Pursuit of Beauty," Paper prepared for delivery to a Symposium of the Natural Resources Institute, The Ohio State University, Columbus, Ohio, May 24, 1966.

rating the quality of Michigan State Parks and comparing their spatial relationships to other recreational and non-recreational phenomena. The attraction index includes an analysis of a combination of natural-cultural resources and relates these features to the behavioral characteristics and desires of man in relation to camping. Such a complex resource appraisal for specific points in space is considered to be one of many major contributions of the geographer.[5]

The general theme of the investigation was expanded beyond the descriptive phase useful for area differentiation to include a much wider scope in terms of space and content. An attempt was made to utilize the classificatory scheme in a travel model, under the assumption that campers have the ability to rationalize their choice of a park. In short, the study is an attempt to encompass the major forces which form a system of space relationships. The model, then, includes structural components of two dissimilar landscapes as well as the "connectivity"[6] or information flow between them. By assuming that the distance and population components

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[5]James and Jones, op. cit., p. 230.

[6]Ackerman, op. cit., p. 437.

within the model were correct, then the addition of these components and the resulting spatial connections illustrated provided for an analysis of the validity of the classification scheme, that is, the attraction indices.

The classification of phenomena is the major task of any science. A basic notion as to what constitutes the attractive qualities of a park for any activity is a necessary prerequisite for moving ahead to more difficult problems concerning the spatial content of recreational land use. The attraction index provides a basic classification and rating scheme and in itself provides clues for the spatial interconnections that are operative at one point in time. Continued research along these lines is commonly recognized as a contribution to the discipline of geography and also to applied problems in outdoor recreation research.[7]

Further development of models such as this one, tested in a variety of spatial situations, will assist in building a framework for planning and locating outdoor

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[7]For a general discussion of what geographers have done and are qualified by their training to do for outdoor recreation research see Richard E. Murphy, "Geography and Outdoor Recreation: An Opportunity and An Obligation," The Professional Geographer, Vol. XV (September, 1963), p. 33, and R. I. Wolfe, "Perspective on Outdoor Recreation - A Bibliographical Survey," Geographical Review, Vol. LIV (April, 1964), p. 203.

recreation sites. As the use of outdoor recreation sites increases and outdoor recreation demands grow, the adage that "Parks are like gold, where you find them,"[8] is no longer applicable. Meeting these recreational demands is highly dependent on the proper location of recreation sites. It is clearly within the sphere of the geographer to find solutions to these locational problems.

[8]From a presentation by Newton B. Drury, California Chief of Beaches and Parks and former Director of the National Park Service, to the National Conference on State Parks, November, 1957.

APPENDIX A

APPENDIX A

STATE AND LOCAL STUDIES OF ACTIVITY PREFERENCE PATTERNS

Attempts to associate other outdoor activities with camping are based on national surveys found in a number of the ORRRC Reports. This national and regional information must be compared with somewhat different data which is available for Michigan. Two statewide surveys of visitors to Michigan State Parks conducted in the last decade included questions on visitor activities while in parks.

The first of these, the Michigan State Park Users Survey,[1] consisted of two parts--one done by 1,452 personal interviews, the other by distribution of a questionnaire to be filled out voluntarily by park visitors. (Statistical sampling theory was not applied to the personal interviews.) Results of the activity preferences from both are listed on Table 15. For the visitors' voluntary responses activity preferences are arranged in decreasing order. Neither the personal

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[1]Dahle, op. cit.

TABLE 15.--Per cent of activity participation preferences from personal interviews and voluntary responses Michigan State Parks - Summer, 1956

Activity	Personal Interviews (Total = 1,452)	Voluntary Responses (Total = 4,147)
Swimming	20.0%	21.0%
Relaxation	.2%	21.0%
Boating	5.0%	18.0%
Camping	39.0%	15.0%
Picnicking	17.0%	15.0%
Fishing	14.0%	10.0%
Hiking	2.0%	9.0%
Nature Study	****[a]	4.0%
Touring	3.0%	1.0%
All or Most of Above	11.0%	2.0%

[a]Not a category used in personal survey.

Source: Thomas L. Dahle, <u>Michigan State Park Users Survey, 1956</u>, Bureau of Business Research, College of Business and Public Service, Research Report Number 19 (East Lansing, Mich.: Michigan State University, 1956), p. 8.

interviews nor the voluntary response questionnaires identifies campers' activity preferences separately, but it is possible to generalize that water activities were very important in Michigan State Parks in 1955. The study indicates that swimming, picnicking, fishing, relaxing, and camping were popular activities, while boating, hiking and nature study were less popular.

A second statewide study on state parks and public lands conducted in 1962, commonly known as the Van Til Report,[2] included a park users survey at thirty-five state parks. Nineteen questions were used, the majority of them pertinent to this discussion. Even more important, a preponderance of the 2,000 visitors surveyed were campers.[3] Findings of this report are related to the present analysis; apparently, however, no measures were taken during the survey to allow for statistical testing of the results, so reliability of the data is open to question and only generalizations can be drawn from the survey.

One survey question requested respondents to list their primary purpose in visiting one of the Michigan

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[2] Report of Committee on State Parks and Public Lands, op. cit.

[3] Ibid., p. 8. The report does not say how many persons in the survey were campers. "There were 2,000 questionnaires distributed--mostly to Park Campers in 35 State Parks."

State Parks. They were asked to order their preferences in terms of recreation, scenic, or historic purposes. Answers to the questions indicated that 86% of the respondents considered recreation as their primary purpose, while 12% listed scenic and 1% listed historic. Recreation is difficult to define, but as the report states, the implication is that facilities for recreational activities may be more important than the natural environment of the park. This statement is essentially in agreement with the previous quotation from Perloff and Wingo;[4] that is, that activities are the center of attraction and are directly dependent upon activity facilities available.

The report also states that the majority of campers apparently did not consider camping as a recreational activity; the respondents believed camping was a means to prolong a visit and participate in recreational activities within the parks.

> The most conclusive result of this survey is the desire and need of the camper for adequate swimming facilities. Suitable water for swimming is necessary for the campers as indicated by the fact that larger proportion of users do not stay at parks where swimming is unavailable than those who do not stay at parks without fishing or boating. (Sixty percent to 30% to 25 percent respectively).[5]

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[4]Perloff and Wingo, op. cit., p. 89.

[5]Report of Committee on State Parks and Public Lands, op. cit., p. 9.

A majority of campers interviewed in this survey did not require boating as a part of their recreational activities. When questioned about the most enjoyable activity while on vacation at a Michigan State Park, 51% preferred camping; 16% swimming; 11% sightseeing; 3% visiting; and 2% boating.[6] Although campers were asked to state their preferences for specific groups of recreational activities, the total responses were insufficient for proper analysis. It was obvious, however, that swimming was preferred when it was included as one of the activity choices.

In 1958, a survey similar to the Van Til Report was undertaken in twenty-seven state parks in Wisconsin.[7] Activity preferences were included in a question on the recreational purpose of a visit to a park. Since day users as well as overnight visitors were interviewed, a comparison of the results with the Michigan camping data is hampered. Sightseeing was stated as the primary purpose by 34% of the visitors; picnicking, by 19%; camping, 17%; and swimming, 14%. Boating, nature study, and fishing attracted a small percentage of the visitors to Wisconsin parks.[8]

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[6] Ibid., p. 14. The respondents answers to this question seems to contradict the previous statement that campers did not consider camping as recreation. When asked the most enjoyable activity, they overwhelmingly stated camping.

[7] Hutchins and Trecker, op. cit. [8] Ibid., p. 19.

During the summer of 1959, the Department of Resource Development of Michigan State University conducted comprehensive interviews with vacation campers at seven selected campgrounds in Iron County, Michigan.[9] None of these campgrounds were in a state park, but the results of the survey are still meaningful if the camping population is assumed to be similar in origins and socio-economic characteristics to campers visiting Michigan State Parks.[10]

The survey asked, "What would you say were the one or two things you enjoyed most?" Forty per cent of the men and 20% of the women interviewed considered water-oriented activities (fishing, swimming, boating) the most desirable.[11] For example, fishing was preferred by 48% of the men; swimming, by 15%; relaxing, 11%; and hiking, 2%. Similar preferences were indicated by women campers, with the exception of a slight preference for swimming over fishing. Hiking was more popular with women than with men by a margin of 7%.[12]

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[9] Gilbert, op. cit.

[10] This assumption has been made after consultation with L. M. Reid, director of the survey. The county parks in Iron County are considered to be on a par with most state parks. The 1959 survey indicated that the county parks surveyed were attracting visitors from long distances, comparable to the attraction areas of state parks. This county, incidentally, contains no state parks.

[11] Gilbert, op. cit., p. 118. [12] Ibid., p. 131.

APPENDIX B

APPENDIX B

ELEMENTS OF THE NATURAL ENVIRONMENT ATTRACTIVE FOR CAMPING

Each natural resource variable is analyzed in the discussion that follows in terms of its significance in outdoor recreational activities. The item is then classified and scaled and its usefulness in the final index is explained. The fact that some variables did not ultimately contribute much to the index does not mean that they might not be useful in another type of attraction index, or useful if scaled by other methods.

Terrain

The forms and features of the landscape have a considerable affect on the type of outdoor recreational activities pursued in a given area. A level terrain is desirable for camping, assuming well-drained soils, while for picnicking an undulating terrain may be favored.[1] A level area with a sharp rise in terrain is ideal for archery and rifle ranges. For hiking, the most important of the land activities with the exception of camping, trails are often more

[1]U. S., Forest Service, *op. cit.*, p. 80.

intriguing if they traverse a rough or undulating terrain. A landscape of this type will frequently afford vistas. The same general statements could be made concerning bridle trails.

The application of scales to measure the terrain and to isolate unique landforms is formidable. Terrain measurements are less vexing conceptually than the problem of identifying classes of terrain types, in that slopes and local relief as differentiating characteristics can be measured. Landforms for outdoor recreation, although inherently a part of and included in such measures as slope and local relief for terrain, are more difficult to rate numerically. In this analysis a simplified measure is adopted for landforms.

Reid in ORRRC Report 5 measured terrain by subjective classifications such as flat, rolling, hilly, or mountainous,[2] and the Bureau of Outdoor Recreation has a similar rating on their inventory forms. A rating of this type, however, requires a visual inspection of the site and some knowledge of the local relief and amount of slope. If the same individual or survey team judges the terrain for every recreational site evaluated by this method, as was the case in Reid's study, then consistency of judgment could be expected. The problem in constructing this type of scale is

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[2]ORRRC Report 5, op. cit., p. 13.

that no clear-cut numerical values can be assigned. A different team might classify many of the same recreation sites quite differently, depending upon their individual backgrounds and academic training.

Since the Bureau of Outdoor Recreation inventory forms had been completed for Michigan State Parks and these forms were made available to the author, the terrain characteristics--hilly, rolling, and so forth --were copied on the inventory sheets for later use if necessary. These data were not used in the final analysis, however. Instead, more exact measures of terrain in each park were adopted.

The local relief of each Michigan State Park was measured from U.S. Geological Survey topographic quadrangles; when these were not available, it was taken from Park Master Plans. For Michigan it is assumed that the greater the local relief, the more attractive the park, although this might not hold true for state parks in more mountainous states.

An additional measure of terrain by per cent of slope was proposed in the Forest Service Work Plan.[3] This survey recommended classifying and rating per cent of slope in the following manner:

a. Abrupt--Slopes of 30% or more with a

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[3] U. S., Forest Service, _op. cit._, p. 80.

value of 4.

b. Irregular--Slopes of 20-30% with a value of 3.

c. Rolling--Slopes of 10-20% with a value of 2.

d. Regular--Slopes of 0-10% with a value of 1.

The Work Plan states that slopes of 30% or more were not suitable for occupancy in terms of campground development or for most land activities. Directly measuring slopes in each of the Michigan State Parks was considered extremely time consuming and was not attempted, particularly after another source of slope and terrain information was recognized.

The additional source is the work of the geographer Hammond, who has developed a map with "Classes of Land-Surface Form in the Forty-Eight States."[4] Three measures of terrain are included: per cent of slope, designated by a capital letter A, B, C, or D; local relief, expressed by a number 1 to 6; and profile type, shown by a lower case letter. These three measures are listed below.

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[4]E. H. Hammond, "Classes of Land-Surface Form in the Forty-Eight States," Annals of the Association of American Geographers, Map Supplement No. 4, LIV (March, 1964).

SLOPE (1st letter)

A. 80% of area gently sloping.

B. 50-80% of area gently sloping.

C. 20-50% of area gently sloping.

D. 20% of area gently sloping.

LOCAL RELIEF (2nd letter)

1. 0-100 feet.

2. 100-300 feet.

3. 300-500 feet.

4. 500-1000 feet.

5. 1000-3000 feet.

6. 3000-5000 feet.

PROFILE TYPE (3rd letter)

a. 75% of gentle slope is in lowland.

b. 50-75% of gentle slope is in lowland.

c. 50-75% of gentle slope is on upland.

d. 75% of gentle slope is on upland.

Since this classification embodies many of the terrain qualities inherent in selecting and classifying the qualities of recreation sites, Hammond's map was used to classify the terrain characteristics of the Michigan State Parks.

Parks were found to be located within six different classes, from A1 to B4b. These classes were recorded as A1 = 1, A2b = 2, ... B4b = 6. The assumption is made that the more slope, the greater the local relief, and the more land in upland, the more attractive the park is. As an example, Porcupine Mountains State Park is located within a B4b classification, and therefore received a numerical score of 6; Bay City State Park, located in an A1 area, received a score of 1. This classification and scoring system for terrain seems ideal and should not be overlooked in future studies. In the technique used for combining the numerical variables into an index, however, it was found to be inadequate as a measure when compared with local relief. Consequently, it was not used in computing the final index in this study.

Measurement of various landform types is more difficult than measurement of terrain. As with terrain, unusual landforms add to the scenic qualities of an area. Michigan parks do have atypical landforms such as falls, high cliffs, overlooks, massive sand dunes, and springs. Features of this type were recorded on the inventory sheets for each park. A suitable way of measuring these features could not be devised. To include them within the index, they are treated as binary data. This avoids the problem of estimating the intangible value derived from features of this type, but at the same time, acknowledges the presence or absence of the feature in a park. The parks receiving a score of 1 for having one or more of these features can be identified in Table 18, Appendix D.

Size of Park

The acreage of a park is an additional variable directly associated with terrain. This variable, included as a component within the index, is excluded in the final model. It is evident in the discussion that follows that the assignment of numerical values to physical environmental variables inherently recognizes the size of the park. Some additional reasons for its exclusion are given in Chapter IV.

Vegetation

The biotic character of a recreation site, when considered with terrain, may add untold value to all recreational experiences. Hiking, including nature walks, is the outdoor activity that benefits directly. Nature study is enhanced if a wide variety of biotic types are available, or if one or two atypical types are abundant.

The vegetative character of each park is analyzed, classified, and scaled into one of four classes:

4. Evergreen.
3. Mixed Evergreen and Deciduous.
2. Deciduous.
1. Barren.

This scale of vegetation desirability for a park is adopted and condensed from the Meramac Basin Study.[5]

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[5] Ullman, Boyce, and Volk, *op. cit.*, p. 44.

This scale is certainly open to questions of judgment. Most campers in Michigan State Parks are from the more populated southern counties, so parks with predominantly evergreen vegetation offer the majority of campers a marked change in vegetative character from that of their home area. Such a change is assumed to be a positive quality factor.

Some additional measures of quality of vegetation are also attempted. Parks with large stands of virgin timber are rated on a binary basis. Virgin timber stands are a rarity in this region, found only in three parks, and are assumed to be desirable for enhancing the total recreational experience. Another measure, the wilderness quality of a park, also is scaled on a binary basis. If a park is 5,000 acres or larger and has few unnatural environmental detractions, it is rated as a "wilderness type" park. This definition is similar to that established by the U. S. Forest Service for virgin areas.[6] The three parks that fit this classification have unique physical qualities, including a vast area of virgin and second growth forests, that could not be overlooked. Certainly campers who desire developed campgrounds along with the opportunity for day-long hikes into the semi-wilderness, would find these parks desirable.

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[6]U. S., Forest Service, _op. cit._, p. 11.

Shade

Camping enjoyment is usually increased if campsites are well shaded, although not always. In northern Michigan direct sunlight may at times be preferred by campers, not only for warmth but to hasten the evaporation of moisture from tents. The Gilbert Study included a question on shade in the campgrounds. In this survey it was found that 95% of the men and women campers preferred well-shaded campsites.[7] With this information in mind the amount of shade in each state park campground was estimated. One of four percentage figures--75%, 50%, 25%, or 10% of the area in shade--is used as a measure of this quality.

Wildlife

The wildlife of a park can be one of the most gratifying amenities. Empirical measurement of this amenity for an index of attraction, however, is quite burdensome. No data on the wildlife of the parks were collected for use in this analysis.

Climate

The climate of parks can affect activity use more than any other factor. Campbell discusses three general ways in which climate can encourage or discourage

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[7]Gilbert, op. cit., p. 122.

the use of a recreation area.[8] The first of these is the effect on human comfort, such as the sensible temperature. This has been measured by the U. S. Weather Bureau in a comfort index, in which extreme discomfort is felt when the temperature and humidity are high. A lack of available data precluded the use of a comfort index for each park in the attraction index.

A second category discussed by Campbell is the psychological effect of climate. This intangible effect occurs when cloud overcast shuts out direct sunlight for long periods of time, or when precipitation occurs for prolonged periods. For hay fever sufferers, certainly the psychological boost received by visiting relatively pollen-free areas of northern Michigan is large. Rainy periods or a lack of sunshine are not necessarily detrimental to the relative attractions among Michigan State Parks, therefore, these elements are not measured.

Campbell's last category is the effect of climate on outdoor activities per se. Climate primarily affects water activities; land activities to a lesser extent. A high comfort index in urban areas may encourage the populace to travel to and camp in a state park. The comfort index may still be high at the park, but heat and humidity are often tolerated better in an outdoor

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[8]Campbell, op. cit., p. 36.

setting, particularly if swimming is a possibility.

Climate also directly affects the temperature of the water. Other physical variables, however, also affect water temperatures and the activity of swimming. If the water temperature is sufficiently warm --generally above 68°F.--swimming frequently will be attempted.[9] Even if the water temperature is suitable, a combination of low air temperature and high wind may dampen enthusiasm for swimming. Sunbathing, considered as a part of the swimming experience, is directly related to the availability of direct sunlight.[10]

The Forest Service suggests that the temperature differential between a recreational site and the user population centers be used as a measure of attractiveness.[11] A similar measure was used in ORRRC Report 5.[12] Recreation sites were scaled in this study in terms of "climatic relief."

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[9]U. S. Forest Service, op. cit., p. 84.

[10]In one survey, 5.9% of all groups taking part in sunbathing as an activity were dissatisfied with the activity. Thirty per cent of the reasons cited for dissatisfaction could be attributed to bad weather, referring to clouds, cold, and wind. (ORRRC Report 5, op. cit., p. 34.)

[11]U. S. Forest Service, op. cit., p. 79.

[12]ORRRC Report 5, op. cit., p. 217.

Excellent--High relief from discomfort--
20° Differential

Good-------Moderate relief from discomfort
--10° Differential

Fair-------Slight relief from discomfort--
0-10° Differential

Poor-------No apparent relief--Negative
Differential

In addition to temperature differential, scaling was done on the basis of other atmospheric conditions. For one recreation site near Los Angeles, smog was recognized in rating the recreation site.[13] The idea of a temperature differential between parks and the origins of a majority of users has considerable merit, but is not undertaken here. The major reason is the complexity of the measure involved for fifty-nine parks and the fact that the origins of users were not clearly established at the time the index was constructed.

Measuring the climatic effect on outdoor activities in Michigan State Parks between June and September is not as easy as it might seem; lack of suitable climatic data is a major problem. As a result, air temperature is the only measure used. A majority of parks keep a daily temperature record; however, no

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[13]Personal conversation with L. M. Reid, May 18, 1965.

indication is given as to the time the temperature is recorded. When records of this type were available, air temperatures at each park for July were averaged and recorded. If air temperature was not available at the park, the average July temperature at the nearest weather station was used. This measure gives parks located in northern Michigan a higher attraction rating than parks in southern Michigan.

Water Resources

The importance of water-related activities to campers has already been emphasized. Not only are water-based activities preferred, but other outdoor activities are more attractive when undertaken near water sites.

Most of the variables selected and measured are related to inland lakes and Great Lakes characteristics, with a limited amount of variables devoted to the characteristics of rivers and streams. Rivers and streams are more difficult to develop and utilize for water activities, particularly for swimming, and river or stream frontage adjacent to campgrounds is less desirable than lake frontage. However, the former is preferred to no water frontage at all.[14]

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[14] Gilbert, op. cit., p. 123.

Size of the Water Body

The importance of the size of a body of water varies when considering water activities. For swimming, which utilizes the margins of a water body, size is important for its relation to temperature. A very large body of water, if of sufficient depth, can be a very cold one. As mentioned under climate, swimming is not a popular activity if the water temperature is below 68°F.[15] Lake Superior, as a result of its size and great depth, frequently is not utilized for swimming. The waters of Lakes Huron and Michigan attain somewhat warmer temperatures, and as a result, parks located on these lakes are popular for bathing. In contrast, a small, shallow inland lake can heat to temperatures of 80° or more. Lakes of this type, although intensively used, may be too warm for the enjoyment of some bathers.

The same records that included data on air temperatures for parks include space for recording water temperatures. Unfortunately, Conservation Department records for July,1963 included water temperatures for only twenty-two of the thirty-eight parks where it is possible to swim. For these twenty-two parks, water temperatures for the month were averaged. July water temperatures for the remaining eleven parks were

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[15]U. S. Forest Service, _op. cit._, p. 84.

estimated with the assistance of planners in the Parks Section of the Conservation Department. These estimates and the twenty-two average temperatures are used as one quantitative measure of the swimming enjoyment in parks where swimming is permitted. A park with relatively high water temperature is considered to be more attractive for swimming than parks with lower water temperatures.

The size of the water body also is extremely important for activities requiring the use of watercraft. Congestion of motor boats on inland lakes in Michigan has become a major problem in recent years.[16] "Rule of thumb" capacity standards for this activity as a partial planning guide for reducing water congestion have been scarce.[17] The acreage of inland lakes with public access for boating is used as one measure of the quality of the water resource for boating and

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[16] C. S. Van Doren, "Recreational Boating in Michigan," Unpublished paper presented at Michigan Academy of Science, Arts and Letters, Wayne State University, Detroit, Michigan, March, 1961.

[17] One of the few "rule of thumb" standards of this type was located. This study stated: ". . . it has been assumed on the basis of interviews and observation that there is a minimum requirement of 20 acres of a desirable degree of skiing satisfaction." This study also recommends that inland lakes of less than 50 acres should have water skiing prohibited. Wisconsin, Department of Resource Development, Recreation in Wisconsin (Madison, Wisconsin, November, 1962), p. 47.

as a measure of the total scenic qualities of the park. A measurement of this type means that the largest lakes are the most attractive,as large lakes can accommodate more boaters, fishermen, and water skiers with less congestion and possibly less conflict between water activities.

An additional measure of size relative to water activities is also attempted. Some boaters prefer to pleasure cruise, and navigable connections between lakes add to this activity experience. Since there are state parks located on inland lakes that have navigable access to adjacent lakes, this opportunity is included as a variable.

A different analysis is necessary for the Great Lakes. The dangers of boating on the Great Lakes in small boats except during periods of assured calm are obvious. There are few developed boat launching sites in Michigan State Parks with access to Great Lakes. Parks on the Great Lakes are used intensively, however, for swimming, shoreline hiking, and sunbathing. For this reason the foot frontage of a park on the Great Lakes is used as a measure of size for this variable, complementing acreage measure of size for inland lakes.

Shapes of Water Bodies

The shape of a water body, while not of importance for swimming, is very important for water skiing and boating. A large, round lake is much safer for water skiing than an elongated, narrow one. In contrast, a narrow lake with irregular, penetrating spurs may be very popular for pleasure cruising. Sailing requires a large open space for unobstructed winds, while canoeing may be hindered by these characteristics. The shape of water bodies is briefly discussed here to take cognizance of its importance, but no measures of this variable are attempted for the index.[18]

Rivers and Streams

For river waters size and shape are less important, since few water activities are undertaken unless the river is of sufficient width for boating. In Michigan State Parks there are few points of access for boaters, and there are no developed swimming sites on river banks, but the rivers are important for such activities as bank fishing, hiking along the banks, and canoeing. The velocity of a river or stream and obstructions such as falls and rapids do affect water-related activities. Streams and rivers with swift currents are sometimes enjoyable for "white water" canoeists, while others prefer calm

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[18]For a method of measuring shapes that might be useful in classifying the shapes of inland lakes for planning purposes, see Chapter III in William Bunge, Theoretical Geography, Lund Studies in Geography, Ser. C. General and Mathematical Geography No. 1 (Lund, Sweden: C. W. K. Gleerup, Publishers, 1962).

water. In many cases rivers containing "white waters" were recorded, but this variable was not used in the index since few of the parks are large enough for long canoe trips. The length and width of the river and stream frontage in each park was determined, and these values were used as measures of the quality of this resource.

Water Quality

The water quality of a lake or river in relation to water activities can be measured by its turbidity, temperature, and the amount of pollution. Turbidity is probably the most difficult to measure and the one for which information is lacking. Obviously a clear lake or river is aesthetically preferable to a cloudy or murky one. When information on turbidity was available, it was recorded on the inventory sheets but it was not used in compiling the final index because a measure of this variable was impossible to obtain for all parks.

The temperature of a water body has been discussed previously. Water temperature is directly related to the depth of a lake and its circulatory system. A large, shallow lake will have higher water temperatures than a deep lake and, depending upon its size and water circulation, varying degrees of pollution.

The effect of polluted water is felt more directly by park visitors. Polluted waters do not necessarily preclude boating as an activity, but could temporarily hamper and even curtail swimming and water skiing if infectious organisms or organic chemicals were of sufficient content to endanger those in contact with the water. Pollution problems are more acute on the Great Lakes and some Michigan rivers than on inland lakes. One state park, Sterling-Monroe, received a lower activity rating because pollution of Lake Erie waters has required the Conservation Department to post no-swimming signs at this park. A measure of pollution was recorded but was not used in the index because of incomplete data. Pollution has been indirectly measured, however, in terms of a fishing quality measure. Pollution, water temperature, and depth of a water body all influence the fish habitate and therefore have a direct bearing on the success and quality of this outdoor activity.

Fishing Quality and Success

Fishing ranks second among the activities preferred by campers. For this reason the fishing quality and fishing success on water bodies located within or adjacent to Michigan State Parks was recorded for the attraction index. Quality as used here implies the type of sport fish, that can be caught, such as pike and trout, as opposed to less desirable species. Success implies a reasonable probability of catching a desirable species while on a camping trip. Each of the inland lakes and rivers having access points within Michigan State Parks was rated for fishing quality and success by Dr. W. H. Tody of the Fish Division of the Michigan Department of Conservation according to the following numerical scale.

4 -- Excellent.

3 -- Good.

2 -- Medium or Average.

1 -- Poor.

0 -- None.

Similar ratings were applied to Michigan State Parks located on the Great Lakes, providing a dock or pier was accessible to those wishing to fish. These structures did not have to be located within the park proper but within a reasonable walking distance (one mile) from the campground. A rating of this type is an empirical estimate on Dr. Tody's part, but with his knowledge of creel census data, fish habitat characteristics, and when and where lakes or rivers have been stocked, his judgments are considered the best available.

Beach Characteristics

Since swimming was the most popular of all outdoor activities preferred by campers, considerable attention was given to the quality of beaches on the Great Lakes and inland lakes. Two surveys already mentioned point out the importance of beaches in state parks. The 1956 Dahle Survey states that when given an opportunity to suggest improvements in parks, the public expressed a desire for extending and enlarging beaches, although desire for more beach area ranked twelfth out of nineteen suggestions on the list (see Table 16).[19] The 1961 state park visitors in Wisconsin were much more positive in their desire for beach improvements. Of eleven major improvements suggested by visitors, the need for beach improvements was ranked third.[20]

Five beach characteristics assumed to effect the attractiveness of a park for swimming as well as wading, sunning, and shoreline hiking are length and width of the dry beach, composition of the dry and wet beaches, and distance of the wet beach to a five-foot depth.[21]

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[19]Dahle, _op. cit._, p. 10.

[20]Hutchens and Trecker, _op. cit._, p. 37.

[21]The previously mentioned _Work Plan for the National Forest Recreation Survey_ recommended these factors as attributes for utilitarian use of beaches. Many of these same attributes were recommended by a geographer and

The length and width of useable beach frontage was estimated from Park Master Plans and from discussion with employees of the Parks and Recreation Section of the Conservation Department. In some cases the length of beach corresponded with the total water frontage in a park, but this was not always true. The footage of beach length was used as a measure of attractiveness--the longer the beach, the more attractive the park. The width of beaches was judged in the same manner. Beaches with widths of fifty feet or more, for example, have been recommended as best for swimming and boat launching purposes.[22]

Rating composition of the dry and wet beaches might have been done according to the system recommended by the U. S. Forest Service.[23]

5 -- Sand.

4 -- Gravel.

3 -- Timbered.

2 -- Soil-Mud.

1 -- Rock.

Without on-site evaluation of the quality of beaches a rating of this type was impossible. If a personal

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measured in another area in 1948. See Alfred W. Booth, The Lakes of the Northeastern Inland Empire, A Study of Recreational Sites, Bulletin No. 5 (Bureau of Economics and Research, State College of Washington, Pullman, April, 1948).

[22]U. S. Forest Service, *op. cit.*, p. 85. [23]*Ibid.*

inspection of the beaches had been possible, then both dry and wet beaches could have been evaluated in detail. For example, a fine sand beach extending from the high water mark for more than fifty feet could have been scored higher than a sand beach with gravel at the high water mark. Dry and wet beaches are scored on a binary basis here, 1.0 for sand beach and 0.0 for gravel or rock. These scores were allocated with the assistance of staff members of the Parks Section, Conservation Department. The wet beach score was applied to the composition of the wet beach to a depth of five to six feet. This evaluation was made for swimming activities since wet and dry beach composition is not as crucial for boating activities. However, good characteristics for swimming are also good for boating.

The slope of the off-shore bottom also was estimated. A distance of 100 to 300 feet to a five-foot depth was considered the most desirable. In a few parks the five-foot depth is not reached before 300 feet. These wet beaches are thought to be less desirable from one safety standpoint. At these sites, children could advance a long distance from shore, and if for some reason their life were endangered, a would-be rescuer would have a lengthy span of water to cross before reaching them. However, from another viewpoint, a gentle slope, regardless of the length from shore to a five-foot depth, provides a less dangerous situation in that there is less opportunity for a child to step into deep water by moving only a few feet. Taking this viewpoint, it was decided that the estimated length of the beach to a five-foot depth would be used as a measure. This means that parks with wet beaches of gentle slopes are more attractive than those with steep slopes. Such a judgment is biased in favor of swimming and is not necessarily good for boat launching. For boating, slopes should be greater, dropping rapidly at least to a two-or three-foot depth, and reaching a five-foot depth within twenty-five feet.[24] Since swimming is the more important of these two activities, the qualities ideal for boating have been placed secondary to swimming qualities.

Cultural Features

The term "cultural features" is defined as evidence of past or present human occupance or activity in an area. Several Michigan State Parks contain historical structures that constitute attractions in their own right. A good example is Fort Wilkins State Park, with the reconstruction of a nineteenth century settlement and fort. Archeological attractions also

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[24] *Ibid.*

fall into this category as do unique features of a contemporary nature in sight of a park--such as the bridge across the Straits of Mackinac or the view of shipping on the Great Lakes.[25]

The measurement of cultural or historic features, like natural features, is difficult. As a result, cultural features at a park are also treated as binary variables.

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[25]The Van Til Report found that campers in Michigan State Parks were not interested in the historic or natural aspects of a park or its environs. The report elaborates by saying that this is probably a truthful statement, since there were only two parks with historic features of significance in the survey and the state's naturalist services were limited to a few parks. The report suggests that more public interest might be demonstrated if these aspects of a park's attraction received more emphasis. Report of Committee on State Parks and Public Lands, op. cit., p. 10.

APPENDIX C

APPENDIX C

RATING THE QUALITY OF FACILITIES AND SERVICES

Water Supply

The water supply in campgrounds in Michigan State Parks was not measured for inclusion in the attraction index. The assumption is made that a sanitary water supply is provided at convenient locations in all parks.[1] When some campgrounds are at maximum capacity for prolonged time periods, there is evidence of minor dissatisfaction with the water supply. Campers also have expressed a desire for tap water as opposed to pumps.[2] Such dissatisfactions, however, are minor relative to other facilities and services.

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[1]Minor dissatisfaction was expressed by respondents surveyed in ORRRC Report 5 as to the location of the drinking water supply. Overall, the public expressed satisfaction with the drinking water supply at the sample locations, in spite of the fact that one location had no water and visitors had to bring their own. The report does not elaborate on this point, but it can be assumed that the attractiveness of this particular area was reduced to a large number of potential campers. This means that its attractiveness to those wishing to be isolated was probably increased. ORRRC Report 5, *op. cit.*, p. 39.

[2]Dahle, *op. cit.*, p. 10.

Campgrounds

Campground, as used in ORRRC Report 5, is a broad term. It encompasses many facilities included at each campsite and utilities available at selected locations within a campground. Facilities to be considered for each campsite include electricity, fireplaces, tables, and the amount of shade or cover in the campground. (The latter feature already has been discussed.) Features frequently present within a campground in a few selected locations are a water supply, toilets, laundry facilities, showers, a wood supply, and refuse containers. In addition, a nearby campground store is frequently considered essential. With the exception of a store or concession, these features of a campground were not explicitly listed in ORRRC Report 5, but complaints expressed by users indicated that they were included in a user's evaluation of the site. A majority of campgrounds at the twenty-four interview locations used in ORRRC Report 5 were satisfying to the public. Specific complaints were directed towards overcrowded facilities, lack of showers, and dirty grounds.

Many of these same complaints have been directed to facilities and services in Michigan State Parks as evidenced by responses to two questions in the

1956 Dahle Survey related to facilities and services.[3] Although the camper population was not interviewed as a distinct group, most of the respondents in the survey directed a majority of their comments towards campground and toilet facilities (Table 16). The Van Til Report indicates that when asked about facility expansions, visitors--primarily campers--made similar responses. Fifty-four per cent thought toilets and shower buildings needed expansion and 35% and 33% respectively expressed a need for more campsites and campstoves.[4]

A direct comparison of these two surveys with ORRRC Report 5 is impossible. The ORRRC Report did not discuss each campground variable that is to be considered here. However, general complaints in Michigan State Parks which indicate crowded conditions, such as the requests for more restrooms and expanded campgrounds, can also be identified in the ORRRC Report.[5]

The Gilbert Study[6] provides the best insights into the facilities and services desired by campers

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[3]Users were asked, "What, if any, facilities appeared to be inadequate or lacking in the park?" and "What new improvements or expansion of present facilities (other than those previously mentioned) should be made?" Ibid., p. 9.

[4]Report of Committee on State Park and Public Lands, op. cit., p. 39.

[5]ORRRC Report 5, op. cit., p. 38.

[6]Gilbert, op. cit., p. 121.

TABLE 16.--Most frequent suggestions for park improvement from Michigan State Parks Users Survey, 1956

Suggestions	Personal[a] Survey	Voluntary[b] Response
More restrooms	55	142
More electric outlets	43	39
Cleaner restrooms	40	34
Better laundry facilities	35	57
Fire places and stoves	34	38
Too crowded (expand park)	33	4
Better parking facilities	30	63
Extend beach	24	16
Boat launching facilities	23	30
Hot water service	23	43
Expand camp area	23	58
More water service	20	--
Mosquito control	17	8
More tables	16	61
Running water	16	42
Showers	16	68
More recreational facilities	13	--
Clean it up	13	14
Diving platform	11	20
Miscellaneous	17	--

[a]The suggestions listed in the original table have been reordered for the personal survey by decreasing number.

[b]Not all voluntary returns were tabulated on this question.

Source: Thomas L. Dahle, Michigan State Park Users Survey, 1956, Bureau of Business Research, College of Business and Public Service, Research Report Number 19 (East Lansing, Mich.: Michigan State University, 1956), p. 10.

in or adjacent to campgrounds. This study grouped facilities and services into categories that would demonstrate desires for developed or underdeveloped campgrounds. In this study, 120 men and women campers were asked to rank the desirability of twenty-two facilities and services in the three campground types listed below.

1. Full facility campgrounds - which included tap water, flush toilets, electricity, tables, and stoves.
2. Minimum facility campgrounds - with pumped well-water, pit toilets, tables, and stoves.
3. Isolated campgrounds - with none of the above facilities and with limited accessibility.

A full facility campground was preferred by 58% of the men and 64% of the women; minimum facility grounds, by 37% of the men and 32% of the women. Only 3% of the men and 1% of the women desired an isolated site.[7] These preferences, when compared with those implied from the Dahle Survey and the Van Til Report, indicate the demand for developed or semideveloped campground facilities. Since the Iron County campgrounds surveyed

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[7] Ibid., p. 121.

in the Gilbert Study are believed to be representative of Michigan State Park campgrounds,[8] many of those facilities and services included in a full facility campground as defined in the Gilbert Study were inventoried and measured for inclusion in the index of attraction.

The twenty-two facilities and services included in the Gilbert Study are listed below. The list has been divided into four groups, according to the categorical ranking of importance as shown by the survey questionnaires.[9]

Very Important	Safe water Toilet facilities Garbage disposal Tables Preserving area in natural state No crowding
Important	Life guard Well-marked trails Electricity Launching ramps Brush clearance
Not Too Important	Laundry facilities Campground showers First aid stations Fireplaces Smooth trails Boat docks
Not at All Important	Boat rental Cafe or restaurant

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[8]This assumption was made after consultation with L. M. Reid, Department of Research Development, Michigan State University.

[9]Gilbert, *op. cit.*, p. 190.

Library facilities
Planned recreation
Child-care facilities

The facilities and services listed in each category of importance include variables that are not necessarily a part of the campground proper, but are related to certain outdoor activities. These are discussed under their appropriate subtitles.

At this point the above list is useful for selecting and measuring important campground facilities and services. Facilities and services directly related to the camping experience within a campground are garbage disposal, tables, electricity, laundry facilities, showers, first aid stations, and fireplaces. If water supply (which has already been discussed) and toilets (to be discussed separately) are added, then a rather complete list of facilities and services for the camping experience can be compiled. If these variables are analyzed according to the preferences in the above list, then it becomes apparent that campers are concerned first with health and sanitation measures and then with facilities and services that make camp houskeeping duties easier.

It is assumed, as was the case with water supply, that facilities directly related to health and sanitation are adequately provided and maintained in Michigan State Parks. This would eliminate garbage disposal as a variable as well as first aid stations.

It is also assumed that a table is a ubiquitous item provided at each campsite.

Electricity, showers, laundry facilities, and fireplaces are amenities to a camping experience. Since they are provided in many Michigan State Parks, and are not available in less-developed campgrounds such as state or national forest campgrounds, they may constitute a part of the camping attraction for some state parks.

The demand for electricity at campsites is evident in the Dahle Survey of 1956 (Table 16). The Van Til Report indicated a need for more trailer sites, which implies sites with electrical outlets.[10] Trailer campers, and many tent campers as well, prefer a source of electricity.[11] The number of campsites with electric outlets in each park is used as a measure of this campground service.

Better laundry facilities were requested by large numbers of respondents in the Dahle Survey, while showers did not receive a high preference rating (Table 16). In the Van Til Report, however, showers were indicated as a feature that needed expansion, and

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[10] Report of Committee on State Parks and Public Lands, op. cit., p. 14.

[11] It is now the policy of the Michigan Department of Conservation to provide electricity at every campsite. (Personal consultation with Harold Guillaume, Parks Section, May 14, 1965.)

no mention was made of laundry facilities.[12] These two variables were listed as "not too important" in the Gilbert Study. Since they are present in Michigan State Parks, as opposed to other public campgrounds in the state, and there is some evidence that they are preferred by campers, their inclusion in the index seemed warranted. These two variables are measured on a binary basis.

Fireplaces for each campsite, like showers and laundry facilities, were ranked as "not too important" in the Gilbert Study. The Dahle Survey (Table 16) and the Van Til Report[13] indicated that fireplaces or campstoves were desired by campers. An inventory of the number of campsites in each park with fireplaces theoretically was possible, but was not felt to be justified. Even when fireplaces are provided, building fires is frequently discouraged in parks due to fire danger.

One remaining feature relative to campgrounds is included in the index. In all of the surveys and reports discussed, an indication of public dissatisfaction has been expressed by such phrases as "no crowding,"[14]

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[12] Report of Committee on State Parks and Public Lands, op. cit., p. 14.

[13] Ibid., p. 14.

[14] Gilbert, op. cit., p. 190.

"too crowded,"[15] or "expand campsites."[16] Obviously the capacity of a campground has an effect on the attractiveness of a park. For this reason, the number of campsites in each park is used as a measure of capacity and, indirectly, attractiveness. It is pointed out in a more detailed discussion in Chapter V that this measure of a park's attractiveness for camping is a primary variable in the index.

Parking

Little dissatisfaction was expressed in ORRRC Report 5 with parking facilities, but there have been complaints of this type in Michigan State Parks, as noted in the Dahle Survey (Table 16) and in the Van Til Report.[17] The size of each campsite is designed to include parking space for one vehicle. Parking problems generally are acute in day-use activity areas, for instance boat-launching ramps. If these activity areas are of sufficient distance from camping areas to require automobile travel to reach them, then parking problems at these areas would detract from part of the camping experience. Time was not allocated for

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[15]Dahle, _op. cit._, p. 14.

[16]_Report of Committee on State Park and Public Lands_, _op. cit._, p. 14.

[17]_Ibid._

collecting data on the capacities of the campground parking lots, but data was gathered--as discussed below--on parking space at boat ramps.

Toilets

If the order of facilities and services in ORRRC Report 5 is to be followed, a discussion of this variable is not warranted at this point. Any discussion of campground facilities, however, must include an analysis of facilities as important as toilets, and for this reason, it is included here.

Toilets were found to be adequate by users of the national sites in ORRRC Report 5, although one-fourth of the respondents were dissatisfied with "dirty" toilets.[18] A similar complaint is listed in the Dahle Survey (Table 16). The public also voiced dissatisfaction with toilet facilities in the Van Til Report, in that more restrooms were needed.[19]

Nothing was said in ORRRC Report 5 on the desirability of flush toilets as opposed to box or pit toilets. In heavily used areas, flush toilets are preferable to box toilets in terms of sanitation and for reducing objectionable odor. Since a majority of campgrounds are used to capacity, flush toilets are

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[18]ORRRC Report 5, *op. cit.*, p. 40.

[19]*Report of Committee on State Parks and Public Lands*, *op. cit.*, p. 14.

obviously better. Consequently, campgrounds with flush toilets are given a value of 1.0, while parks with box toilets are given a value of 0.0. The Gilbert Study offers some justification for this assumption, in that flush toilets were included as a preferred variable for full facility campgrounds.[20]

Marked Nature Trails

Next to the camping experience itself, hiking is the most important land activity. Only a few Michigan State Parks have marked nature trails. These parks are measured by binary scale under interpretative facilities (Table 18) which includes nature trails with interpretative brochures, outdoor centers, informational displays, and guide services for special groups. This variable essentially includes the "signs and information trails" and the "tours and organized group" categories included in ORRRC Report 5.

In gathering information on hiking and nature trails for the attraction index, a more direct measure was used in addition to the interpretative facilities binary measure. Two features related to trails are considered to reflect the quality of this facility--the length of the trails and the extent of trail marking. They are scaled by measuring the length in

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[20]Gilbert, op. cit., p. 189.

feet of all marked trails within each park. For the thirty-two parks with marked trails, these values range from 4,000 to 370,000 feet. This method of measurement means that parks with lengthy marked trails are more attractive than parks with unmarked trails or than parks with no trails. Bridle trails are measured by the same method.

Concessions and Rental Facilities

Since a concession operator in Michigan State Parks in many cases will also rent articles for outdoor activities, these two categories from ORRRC Report 5 are combined. The chief complaint listed in ORRRC Report 5 against concessions and rented facilities was "too expensive."[21] No information is available for Michigan parks on complaints of this type. These two categories have not been evaluated in any of the surveys and studies discussed so far.

Concession and rental operations are amenities to a camping experience. The presence or absence of such services affects the activity participation at parks. Therefore, in parks where they are provided they are considered as assets to the attractiveness of the park. Based on judgment as to what is convenient distance, parks are given a value of 1.0 if there

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[21]ORRRC Report 5, op. cit., p. 40.

is a store less than a mile from the campground. Parks with no stores or stores more than a mile from the campground receive a value of zero on this variable. Parks with boat, canoe, or horse rentals also are scored in this manner.

Boat Docks and Ramps

Users generally were satisfied with boat docks and ramps according to ORRRC Report 5.[22] The primary complaint among the few dissatisfied was that conditions were crowded, particularly at boat ramps. The presence or absence of boat-launching facilities is noted for each park.

There are some parks where congestion problems are acute. Congestion on the launching ramp and inadequate parking space adjacent to the ramp is recorded on a binary basis. This data, however, proved not significant for the index.

The availability of a breakwater or pier within or adjacent to a park located on the Great Lakes is also recorded. These were considered meaningful for strolling and for fishing.

Roads

Road characteristics and conditions in the vicinity of parks are treated superficially. The completed Bureau of Outdoor Recreation Inventory Sheets for each park contained a judgment of access roads, principal road conditions, and accessibility to each park.[23] This data was recorded on the inventory sheet but in the final analysis was not included in the attraction index. The travel model takes this variable partially into account in that time distances are computed on the basis of road conditions and minimum distances.

Other Facilities and Services

The National Survey (ORRRC Report 5) included a category for write-in comments. The comments received in this category were directed toward specific facilities such as fireplaces, tables, firewood, insect control, and playgrounds.[24] Tables have been discussed previously. With the exception of playground equipment, none of these minor facilities and services were inventoried or evaluated for the attraction index.

An effort was made to determine the availability of playground equipment in parks. There are a number of reasons for this. The camping attraction index is designed to reflect the desires of the average party of family vacation campers. Such parties frequently include one or two small children who derive

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[23] U. S., Bureau of Outdoor Recreation, *Inventory, Classification and Evaluation of Existing Outdoor Recreational Areas and Facilities* (Form B.O.R. 8-73), Department of the Interior, Washington, 1965.

[24] ORRRC Report 5, *op. cit.*, p. 42.

considerable pleasure from playground equipment.[25] These facilities serve as a social gathering place for the young and they enhance the camping experience for adults as well. Respondents in the Van Til Report heavily endorsed swing-teeter-slides as apparatus that would be used if available. The report also states that in many cases it is the children who influence where a family takes a camping vacation.[26] Parks which included campgrounds with play equipment were given a score of 1.0, while those without play equipment were assigned 0.0.

Several other facilities and services not mentioned in ORRRC Report 5 which were inventoried and scored for possible inclusion in the index are museums, outpost camps, rifle and archery ranges, dune ride concessions, lifeguards, and bath or beach houses.

Congestion

In all surveys reviewed overcrowded parks were mentioned as a complaint. The attraction index developed for this study does not include this factor. However, data on congestion at boat launching sites on inland lakes and on the per cent of the time each

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[25]"The typical camping family totals 4.6 persons with 2.2 children under 16; . . ." Report of Committee on State Parks and Public Lands, op. cit., p. 9.

[26]Ibid., p. 11.

park was at 100% campsite occupancy during the 1963 season was collected.[27] In a sense, information of this type constitutes a detraction rather than an attraction. Campers may learn that some attractive parks will continuously be full on holidays and weekends and select another less attractive park for camping where they will not have to queue to gain admittance. As the attraction index is refined, it may be possible to utilize congestion figures of this type in such a way that they will negate a portion of a park's attractive qualities.

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[27]One of the purposes for collecting the data on congestion was to use it to test the attraction index after it had been used in a travel model. For example, the attraction indices could be compared to measures of congestion by a correlation analysis.

APPENDIX D

TABLE 17.--Park Inventory Table.

REGION ________ ACREAGE
LAND ______ WETLANDS ______ WATER ______
TOTAL ______

CAMPSITES--LOTTED ______ UNLOTTED ______ TOTAL ______
TENT ______ TRAILER ______ OUTPOST (shelters) ______

PARK NAME ____________________

Terrain--L.R.H. ______ L. ______ ____________
Rank-Rolling ______ Flat ______
Hilly ______ Mts. ______ ____________
Landform Surface ________ ____________
Vegetation
Evergreen ______ Deciduous ______
Mixed ______ Barren ______ ____________
Virgin ______ Cutover ______ ____________
Cover-Shade
100-50% ______ 10-25% ______
25-50% ______ 10% or Less ______ ____________
Unusual Vegetation ________ ____________
Wilderness
No Detractions ______ Serious ______
Minor ______ Unacceptable ______
Substantial ______ ____________
Wildlife Habitat
Excellent ______ Poor ______
Normal ______ ____________
Historical ____________________
Archeology ____________________
Contemporary ____________________
Museum ____________________
Springs ____________________
Falls ____________________
Cliffs ____________________
Overlook ____________________
Dunes ____________________
Interpretive Facilities ________ ____________

TABLE 17.--Contd.

Camping

Store______ In park______
Out park______ ______
Showers ______
Toilet-Box______ Flush______ ______
Laundry ______
Electricity ______
Occupancy--%
90%______
50-90%______
Below 50%______ ______
Play Sports______ Equip.______ ______
Horseback Riding-Rental ______
Miles-No. Trails______
Hiking-No. Trails______
Miles-Trails______
Other__________________________ ______

Great Lakes--______ Total Beach
1 Mile + ______ ______
1/2 Mile to 1 Mile ______ ______
Less than 1/2 Mile ______ ______
______

Water Temperature
73°F+ ______ 68°-72° ______
60°-67°______ 59° Less______ ______
Beach-Width
100'+______ 100'-50'______
50'-25'______ 25' Less______ ______
Beach-Composition
Sand______ Gravel-Rock______ ______
Offshore-Bottom to 5' Depth
Sand______ Pebbles______
Sand + Pebbles______ ______
Distance to 5' Depth
300'+______ 100'-300'______
100'-50'______ 50' Less______ ______

TABLE 17.--Contd.

Swimming ______
  Class A B C D ______
  Bath House______ ______
  Life Guard______ ______
Fishing Quality
  None______ Medium______
  Poor______ Good______
  Excellent______ Pier______ ______

Access
  Distance Paved Highway ______
  Access Roads-Adequate ______
  Princ. Roads-Adequate ______

Rec. Class-(Area)-ORRRC
I-______ III-______ V-______
II-______ IV-______ VI-______ ______
River-Stream
  Length______ Width______
  Flow-Still______ hite______
  Fishing______ Canoeing______ ______

Inland Lakes ______
______
______

No.	Size
______	1000 Acres+
______	50-1000 A.
______	0-50 A.

______

No.	Type
______	Marsh-Bog
______	Marsh-Lake
______	Warm-Water
______	Cold-Water

______

Pollution	No.
None or Minor	______
Polluted-Acceptable	______
Unacceptable	______

______

TABLE 17.--Contd.

Turbidity No. No.		
Clear ______ Murky ______		
Cloudy ______		______
Water Temperature		
73°F+ ______ 68°-72° ______		
60°-67° ______ 59° Less ______		______
Water Level		
Little Change ______		
Moderate ______		
Major Change ______		______
Beach-Length ______________		
1 Mile __________		
1/2 Mile to 1 Mile ______		
Less 1/2 Mile ______		______
Beach-Width		
100'+ ______ 100'-50' ______		
50'-25' ______ 25' Less ______		______
Beach-Composition		
Sand ______ Gravel ______		______
Offshore-Bottom to 5' Depth		
Sand ______ Pebbles ______		
Sand + Pebbles ______		______
Offshore Distance to 5' Depth		
300'+ ______ 100'-200' ______		
100'-50' ______ 50' Less ______		______
Swimming ______________		
Class A B C D		______
Bath House		______
Life Guard		______
Roped Area		______
Boating		
Launching		______
Rental		______
Obstructions		______
Navigable Waters		
Limited		______
Expanded		______

TABLE 17.--Contd.

Water Skiing
  Area-Limited ________
  Extensive ________
Water Congestion
  Major ________
  Normal ________
  None ________
Fishing Quality
  None______ Medium______
  Poor______ Good______
  Excellent______ Pier______ ________

Attendance	Camper Days
1962________	1962________
1963________	1963________
1964________	1964________
Average Temperature Diff.	________

TABLE 18.--Variables inventoried for Michigan State Parks, including possible range of values, number of parks with non-zero value, and source of data. Data collected October, 1964

Variable	Possible Range of Values or Scale	No. of Parks with Var. ≠ 0	Source of Data
1. Park Size	16 to 58,167 acres	64	Michigan Department of Conservation
2. Number of Campsites	0 to 497	59	
3. Trailer Sites	0 = Absent 1 = Present	60	
4. Outpost Camps	0 = Absent 1 = Present	10	
5. Local Relief	5 to 1,356 feet	64	Michigan Department of Conservation and U.S. Geological Survey Topographic Maps

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq 0$	Source of Data
6. Park Surface or Terrain	1 = Flat 2 = Rolling 3 = Hilly 4 = Mountainous	64	U.S., Bureau of Outdoor Recreation, Inventory, Classification, and Evaluation of Existing Outdoor Recreation Areas and Facilities (Form B.O.R. 8-73), Department of the Interior. Washington, D.C., 1965.
7. Area Landscape Surface	1 = A1 (Flat Plains) 2 = A2b (Smooth Plains b=50-75% of slope in lowlands) 3 = A2c (Smooth Plains c=50-75% of slope on uplands) 4 = B2b (Irregular Plains) 5 = B3b (Plains with Hills) 6 = B4b (Plains with High Hills)	63	Edwin H. Hammond, "Classes of Land-Surface Form in the Forty-Eight States, U.S.A.," Map Supplement No. 4, Annals of the Association of American Geographers, LIV (March, 1964).

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq 0$	Source of Data
8. Vegetation	1 = Barren 2 = Deciduous 3 = Mixed Deciduous and Evergreen 4 = Evergreen	64	J.O. Veatch, "Maps of Resettlement Forest in Michigan," Department of Resource Development, Michigan State University, East Lansing, 1959.
9. Virgin Timber	0 = Absent 1 = Present	3	Michigan Department of Conservation
10. Wilderness Classification	0 = $<$ 5000 acres 1 = $>$ 5000 acres	4	
11. Historical Feature	0 = Absent 1 = Present	11	
12. Archeologic or Geologic Feature	0 = Absent 1 = Present	1	

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq$ 0	Source of Data
13. Contemporary Feature	0 = Absent 1 = Present	7	Michigan Department of Conservation
14. Museum	0 = Absent 1 = Present	5	
15. Springs	0 = Absent 1 = Present - accessible by foot trails	6	
16. Falls	0 = Absent 1 = Present - accessible by foot trails	3	
17. Cliffs - Overlooks	0 = Absent 1 = Present - accessible by foot trails	14	
18. Sand Dunes	0 = Absent 1 = Present - accessible by foot trails	7	

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq 0$	Source of Data
19. Interpretative Facilities	0 = Absent 1 = Present	29	Michigan Department of Conservation
20. Average July Air Temperature, 1963	63° to 74° F.	64	Weekly reports submitted by Park Superintendents to Parks and Recreation Section, Michigan Department of Conservation, 1963, and U.S., Weather Bureau, <u>Climatological Data, Michigan, July, 1963</u>, Department of Commerce, Vol. 78, No. 7, July, 1963.
21. Store	0 = > one mile 1 = < one mile	26	Michigan Department of Conservation
22. Showers	0 = Absent 1 = Present	41	
23. Flush Toilets	0 = Absent 1 = Present	47	

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq$ 0	Source of Data
24. Laundry	0 = Absent 1 = Present	38	Michigan Department of Conservation
25. Electricity	4 to 497 Sites	49	
26. Occupancy Per Cent	1% to 90% All Campsites Occupied	50	
27. Per Cent of Cover (Shade) in Campground	75 = 100-50% Cover 50 = 50-25% Cover 25 = 25-10% over 10 = 10% or less	58	Estimates by Planning Staff Parks and Recreation Section, Michigan Department of Conservation
28. Horse for Rent in Park	0 = Absent 1 = Present	4	Michigan Department of Conservation
29. Marked Bridle Trails	15,840 to 29,600 Feet	3	
30. Marked Foot Trails	0 = Absent 1 = Present	33	

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq 0$	Source of Data
31. Length of Hiking Trails	4,000 to 370,000 Feet	32	Michigan Department of Conservation
32. Rifle Range	0 = Absent 1 = Present	3	
33. Archery Range	0 = Absent 1 = Present	5	
34. Dune Ride Concession	0 = Absent 1 = Present	2	
35. Playground Equipment in Camping Area	0 = Absent 1 = Present	41	
36. Frontage on the Great Lakes	880 to 116,160 Feet	32	Estimated from Master Plans of parks provided by the Planning Staff, Parks and Recreation Section, Michigan Department of Conservation

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq 0$	Source of Data
37. Beach Length on Great Lakes	150 to 58,080 Feet	31	Estimated from Master Plans of parks provided by the Planning Staff, Parks and Recreation Section, Michigan Department of Conservation
38. Average Water Temperature--Great Lakes, July	60° to 75° F.	26	Temperatures for 11 parks were obtained from weekly reports of Park Superintendents submitted in 1963. For the remaining 15 parks, temperatures were estimated from the following sources: Great Lakes Research Institute, Currents and Water Mass of Lake Huron (Ann Arbor: University of Michigan, Technical Paper No. 1, July, 1954), and Great Lakes Research Institute, Currents and Water Masses of Lake Michigan (Ann Arbor: University of Michigan, Publication No. 3, 1958)

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. ≠ 0	Source of Data
39. Beach Width-Great Lakes	10 t0 30 Feet	31	C.R. Humphrys, Shoretype Classifications of Michigan Counties (Bulletins 1-29), East Lansing: Department of Resource Development, Michigan State University, 1958, and Estimates by Planning Staff, Parks and Recreation Section, Michigan Department of Conservation.
40. Dry Beach Composition-Great Lakes	0 = Gravel and/or Rock 1 = Sand with few Rocks	26	
41. Wet Beach Composition-Great Lakes	0 = Gravel and/or Rock 1 = Sand with few Rocks	17	
42. Wet Beach Distance to 5' Depth	50 to 999 Feet	29	

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq$ 0	Source of Data
43. Swimming-Great Lakes	0 = Not Allowed 1 = Allowed	25	Michigan Department of Conservation
44. Bath or Beach House-Great Lakes	0 = Absent 1 = Present	14	
45. Lifeguard-Great Lakes	0 = Absent 1 = Present	8	
46. Fishing Quality-Great Lakes	0 = None 1 = Poor 2 = Medium 3 = Good 4 = Excellent	7	Judgmental rating done by W.H. Tody of the Fish Section, Michigan Dept. of Conservation
47. Pier on Great Lakes	0 = Absent 1 = Present	5	Michigan Department of Conservation

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq$ 0	Source of Data
48. River Frontage	250 to 195,000 Feet	22	Estimated from Master Plans of parks provided by the Planning Staff, Parks and Recreation Section, Michigan Department of Conservation
49. River Width	10 to 99 Feet	19	
50. Fishing Quality-River	See Variable 46 Above	27	
51. Boating and Canoeing-River	0 = No Access 1 = Accessible	9	Michigan Department of Conservation
52. Number of Inland Lakes in Park, Accessible to Boaters	1 to 9	38	C.R. Humphrys and R. F. Green, Michigan Lake Inventory Bulletins (Nos. 1-83, By County), East Lansing: Department of Resource Development, Michigan State University, 1962

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. ≠ 0	Source of Data
53. Acreage of Inland Lakes	23 to 17,080 Acres	38	
54. Pollution-Inland Lakes	0 = None or Minor 1 = Polluted but Acceptable 2 = Polluted and Unacceptable for Recreation	64 (5 parks with a 1 or 2)	Records of C.R. Humphrys, Department of Resource Development, Michigan State University
55. Turbidity of Inland Lakes	0 = Clear 1 = Murky 2 = Cloudy	64 (5 parks with a 1 or 2)	
56. Water Temperature-Inland Lakes, July Average	68° to 82° F.	29	Temperatures for 11 parks were obtained from weekly reports of Park Superintendents, 1963. Temperatures for the remaining 18 parks were estimated with the assistance of the members of the Planning Staff, Parks Section, Michigan Department of Conservation

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq$ 0	Source of Data
57. Frontage on Inland Lakes	1,450 to 18,000 Feet	28	Michigan Department of Conservation, Master Plan Maps of Parks. (See Variable 36 above.)
58. Beach Frontage on Inland Lakes	100 to 4,800 Feet	28	(See Variable 36 above)
59. Beach Width-Inland Lakes	15 to 200 Feet	28	
60. Beach Composition-Inland Lakes	(See Variable 40 above)	28	Planning Staff, Parks and Recreation Section, Michigan Department of Conservation.
61. Wet Beach Composition-Inland Lakes	(See Variable 40 above)	26	
62. Wet Beach Distance	25 to 500 Feet	27	

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. ≠ 0	Source of Data
63. Swimming-Inland Lakes	0 = No Swimming 1 = Swimming	28	Michigan Department of Conservation
64. Bath or Beach House-Inland Lakes	0 = Absent 1 = Present	19	
65. Lifeguard-Inland Lakes	(See Variable 45 Above)	20	
66. Boat Launch Ramps-Inland Lakes	0 = Absent 1 = Present	47	
67. Boat or Canoe Rental-Inland Lakes	0 = Absent 1 = Present	16	
68. Boat Launching Congestion	0 = No Congestion 1 = Congestion Apparent	8	Judgment of the Planning Staff of Parks and Recreation Section, Michigan Department of Conservation

TABLE 18.--Contd.

Variable	Possible Range of Values or Scale	No. of Parks with Var. $\neq$ 0	Source of Data
69. Navigable Boating Waters-Inland Lakes	0 = Boating Limited to Lake where Launching was Done 1 = Navigation Expanded by Channels to Other Inland Lakes	8	Judgment of the Planning Staff of Parks and Recreation Section, Michigan Department of Conservation
70. Water Skiing	0 = No Water Skiing 1 = Water Skiing	28	
71. Water Sport Congestion-Inland Lakes	0 = Congestion and Problems Due to Water Activities Generally not Common 1 = Major Congestion and Conflicts	13	
72. Fishing Quality-Inland Lakes	(See Variable 46 Above)	34	(See Variable 46 Above)

TABLE 19.--Estimated origin camper-days, 1962, and actual 1964 camper-days.

County or County Group	Node Number	Estimated[a] Campers 1962	Estimated[a] Camper-Days 1962	Estimated[a] Out-State Revision of Camper-Days	Actual Camper-Days 1964
Alcona & Oscoda	1	318	1,177		1,857
Allegan	2	3,183	11,777		23,306
Alpena & Mont-morency	3	2,327	8,721		5,460
Antrim & Otsego	4	799	2,957		3,176
Arenac	5	323	1,195		1,221
Barry	6	1,595	5,902		11,668
Bay (SMSA)	7	8,437	51,466		45,583
Benzi & Leelanau	8	551	2,038		2,770
Berrian	9	11,328	41,914		28,510
Branch	10	1,923	7,115		7,003
Calhoun	11	12,367	45,758		53,305
Cass	12	1,824	6,749		6,682
Charlevoix	13	922	3,411		2,357
Cheboygan	14	982	3,633		2,304
Clare	15	366	1,354		4,227
Clinton (SMSA)	16	4,570	27,877		15,685
Crawford & Roscommon	17	367	1,358		3,169

TABLE 19.--Contd.

County or County Group	Node Number	Estimated			Actual
		Campers 1962	Camper-Days 1962	Out-State Revision of Camper-Days	Camper-Days 1964
Eaton (SMSA)	18	5,219	31,836		24,214
Emmet	19	1,052	3,892		1,286
Genesee (SMSA)	20	26,173	159,655		210,970
Gladwin	21	357	1,321		5,374
Grand Traverse & Kalkaska	22	2,836	10,493		10,871
Gratiot	23	2,603	9,631		14,743
Hillsdale	24	1,831	6,775		6,633
Huron	25	1,423	5,265		4,534
Ingham (SMSA)	26	13,959	85,150		108,512
Ionia	27	2,736	10,123		15,436
Iosco & Ogemaw	28	825	3,053		6,166
Isabella	29	2,475	9,158		12,222
Jackson (SMSA)	30	11,637	70,986		52,962
Kalamazoo (SMSA)	31	13,020	79,422		71,871
Kent (SMSA)	32	24,207	147,663		323,960
Lake & Osceola	33	499	2,782		3,983
Lapeer	34	1,916	7,089		17,164
Lenawee	35	5,401	19,983		19,028
Livingston	36	1,643	6,079		14,395

TABLE 19.--Contd.

County or County Group	Node Number	Estimated			Actual
		Campers 1962	Camper-Days 1962	Out-State Revision of Camper-Days	Camper-Days 1964
Macomb (SMSA)	37	28,343	172,892		201,425
Manistee	38	1,340	4,958		3,061
Mason	39	1,545	5,716		4,474
Mecosta	40	1,460	5,402		3,371
Midland	41	4,089	15,129		48,455
Missawkee & Wexford	42	1,709	6,323		5,303
Monroe	43	5,666	20,964		35,073
Montcalm	44	1,832	6,778		10,926
Muskegon (SMSA)	45	11,950	72,895		55,948
Newaygo	46	1,081	4,000		8,321
Oakland (SMSA)	47	47,724	291,116		335,010
Oceana	48	543	2,009		3,703
Ottawa	49	7,180	26,566		89,995
Presque Isle	50	846	3,130		2,238
Saginaw (SMSA)	51	14,827	90,445		87,635
St. Clair	52	8,088	29,926		40,873
St. Joseph	53	2,776	10,271		8,039
Sanilac	54	1,112	4,114		6,564

TABLE 19.--Contd.

County or County Group	Node Number	Estimated: Campers 1962	Estimated: Camper-Days 1962	Estimated: Out-State Revision of Camper-Days	Actual: Camper-Days 1964
Shiawassee	55	3,774	13,963		28,886
Tuscola	56	1,989	7,359		13,222
VanBuren	57	2,377	8,795		7,768
Washtenaw (SMSA)	58	13,208	80,569		59,254
Wayne (SMSA)	59	165,337	1,008,556		686,510
Madison, Wisc.	60	17,703	107,988	(1,825)	3,541
Milwaukee, Wisc. (SMSA)	61	76,077	464,070	(7,843)	10,737
Racine, Wisc. (SMSA)	62	11,610	70,821	(1,197)	2,522
Kenosha, Wisc. (SMSA)	63	8,258	50,374	(851)	1,747
Rockford, Illinois (SMSA)	64	15,330	93,513	(4,760)	3,143
Chicago, Illinois (SMSA)	65	398,132	2,428,605	(123,615)	47,818
Peoria, Illinois (SMSA)	66	22,526	137,409	(6,994)	4,589
Champaign-Urbana, Illinois	67	10,531	64,239	(3,270)	3,210

TABLE 19.--Contd.

County or County Group	Node Number	Estimated			Actual
		Campers 1962	Camper-Days 1962	Out-State Revision of Camper-Days	Camper-Days 1964
Hammond-Gary, Ind.	68	39,279	239,602	(10,758)	7,969
South Bend, Ind. (SMSA)	69	17,525	106,902	(4,798)	18,187
Fort Wayne, Ind. (SMSA)	70	18,142	110,666	(4,968)	20,521
Muncie, Ind. (SMSA)	71	9,331	56,919	(2,556)	2,687
Toledo, Ohio (SMSA)	72	30,108	183,659	(13,591)	57,198
Lima, Ohio (SMSA)	73	8,975	54,748	(4,051)	7,283
Cleveland, Ohio (SMSA)	75[b]	110,765	675,666	(49,999)	17,532
Alger County	76	667	2,468		563
Baraga County	77	223	825		637
Chippewa, Luce & Mackinac	78	3,797	14,048		4,466
Delta County	79	2,914	10,782		5,957
Dickinson County	80	2,305	8,528		2,590

TABLE 19.--Contd.

County or County Group	Node Number	Estimated: Campers 1962	Estimated: Camper-Days 1962	Estimated: Out-State Revision of Camper-Days	Actual: Camper-Days 1964
Gogebic County	81	2,248	8,318		1,066
Houghton & Keweenaw Co.s.	82	2,195	8,121		2,549
Iron County	83	863	3,193		1,087
Marquette County	84	4,826	17,856		9,337
Menominee County	85	1,796	6,645		2,695
Ontonagon County	86	333	1,232		1,030
Schoolcraft County	87	713	2,638		991
Duluth, Minnesota (SMSA)	88	18,678	113,936	(911)	2,106
Green Bay, Wisc. (SMSA)	90[b]	9,738	59,402	(1,004)	4,108
Sub-Totals Michigan Counties		523,815	2,870,774	2,870,774	2,921,629

TABLE 19.--Contd.

County or County Group	Node Number	Estimated: Campers 1962	Estimated: Camper-Days 1962	Estimated: Out-State Revision of Camper-Days	Actual: Camper-Days 1964
Out-State S.M.S.A.'s		843,118	5,143,020	242,991	214,898
TOTAL		1,366,933	8,013,794	3,113,765	3,136,527

[a]Estimates are based on 1960 population and participation rates from the National Recreation Survey.

[b]Two out-of-state S.M.S.A.'s, Lorian, Ohio, and Superior, Wisc., were originally included but later dropped from the analysis. The origin numbers were not changed.

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