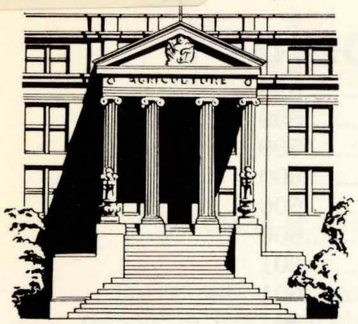

PROJECTING IOWA'S OUTDOOR-RECREATION NEEDS TO 1980

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SUMMARY

Participation in a wide range of outdoor-recreation activities has increased rapidly in Iowa, as elsewhere in the United States, over the last three decades. Substantial evidence supports anticipation of continued increase in such activity for several decades.

Planning for the effective use of available resources to meet rising demand for outdoor recreation requires sound information of several kinds. Data available as a basis for outdoor-recreation planning in Iowa has been limited in both quantity and quality. This study was conducted to provide one kind of information useful for planning purposes. On the basis of a survey of Iowa residents, estimates were made of current (1966) participation in various outdoor-recreation activities. Projections of the extent of participation in these activities were developed for 1975 and 1980.

Sampling of Iowa residents was designed to give each resident, 12 years of age or older, an equal chance of being included in the survey. Questionnaires were used in interviewing 812 individuals who composed the sample and whose responses were included in the analysis. Information concerning participation in outdoor-recreation activities and socioeconomic characteristics was acquired from respondents.

Survey data were analyzed to develop estimates of participation in specified activities during the year from Labor Day, 1965, through Labor Day, 1966. Structural analysis was used to make projections of participation in the same activities for 1975 and 1980. The relationship between participation in each outdoor-recreation activity and various socioeconomic characteristics (e.g., age, education, income) was established. Estimates of these socioeconomic characteristics, the independent variables, were made for the target years. By applying the relationships determined between participation and socioeconomic variables, an estimate was made of per-capita participation in each activity in 1975 and 1980. The rates of participation estimates were applied to the expected population of the state in designated years to develop projections of the amount of participation in each activity in those years. A determination was made of the relative significance of independent variables affecting participation rates in various activities.

Analysis revealed wide variation in the rate of change anticipated in per-capita participation in various outdoor-recreation activities by 1980. Playing golf and bird watching are expected to increase by 107.3 and 73.0 percent, respectively, but little change is anticipated in activities such as hunting, fishing, and horseback riding. The overall per-capita increase projected for the 22 activities considered is 9.4 percent by 1980. Five activities (driving for pleasure, walking for pleasure, picnicking, bicycling, and swimming) accounted for 57.7 percent of the participation estimated in 1966. The increase in per-capita participation in these activities by 1980 is anticipated to be 2.6 percent, while the increase in total participation is estimated to be 10.4 percent.

Projecting Iowa's Outdoor-Recreation Needs To 1980[1]

by Glenn H. Manning, Henry H. Webster, Frederick S. Hopkins, Jr., and Roy D. Hickman[2]

Participation in outdoor recreation is growing rapidly in Iowa and elsewhere in the United States. Recreational visits to national forests have approximately tripled for each decade over the past 40 years (2). In 1960, Americans spent over $11 billion on recreation in national parks, national forests, state parks, and federal reservoirs (3); and this expenditure has substantially increased during the past 10 years.

A study by the Bureau of Outdoor Recreation in 1967 predicted a fourfold national increase in participation in outdoor-recreation activities of all types between 1960 and the year 2000 (14). To meet this expected increase, Iowa developments have included a considerable expansion of parks and other recreational areas in many portions of the state as well as legislation for creation of a National Recreation Area in the Upper Mississippi Valley (19).

Three predominant factors influence past and future trends in outdoor-recreation participation:

1. Population growth, which implies greater participation, all other things being equal.
2. Rising per-capita real income, stemming from increased productivity of labor and other resources. (Increments in income are realized in several forms: increased disposable income, with persons having more money to spend on goods and services, such as outdoor recreation; increased leisure time, reflected in shorter work weeks, longer vacations, or earlier retirement; and expanded public services, such as transportation and facilities for outdoor recreation.)
3. Preferences for recreation, as opposed to other goods and services, possibly as a result of changing occupational patterns, growing urbanization, and advanced levels of education.

These factors all point to a possible need for expanded outdoor-recreation facilities. Expansion may involve both development of more facilities and use of present facilities for a greater part of the year. Moreover, many different patterns could be developed—with quite different results in terms of the numbers of visitors who could be accommodated and the amount of enjoyment provided to these visitors. Agencies engaged in outdoor-recreation planning and development, therefore, must carry out their planning carefully and systematically.

Part of the needed information for resource management planning is economic. Ideally, the resource manager needs information concerning the demand for various kinds of outdoor recreation, the economic or inventory supply of outdoor recreation, plus possible substitutes for outdoor recreation and the costs and benefits of providing outdoor recreation. In many instances, however, information of this type is not readily available; consequently, intensive research is needed.

Forecasting Future Outdoor-Recreation Participation

Even if adequate knowledge concerning present supply, demand, benefits, and costs were available, it would still be necessary to forecast future participation in outdoor recreation to plan wisely. Many intelligent decisions can be made based simply on projections of participation and knowledge of the institutional factors involved in such decisions.

Projections of future participation are important in two areas, among others: (a) planning investments in outdoor-recreation facilities on land presently dedicated to outdoor recreation; and (b) reserving adequate land and water resources for future outdoor-recreation needs. Because participation is measured only for activities in which people presently engage, there is considerable opportunity for mistakes in knowing what people actually desire. People will only participate in activities for which facilities are available. Measurement of participation does not necessarily indicate what they might really want to do. This is one of the serious consequences of mistaking recreation participation for recreation demand. Provision of new kinds of facilities for which a significant demand exists may be neglected, while facilities that are meeting demands adequately are expanded.

Another problem in measuring and predicting outdoor-recreation participation is that experience has been short and data have been lacking. For this reason, extrapolation for a short period is necessary, which can lead to difficulties. These

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difficulties are especially pronounced if trends are not well established. There is further difficulty when it is realized that there is no good reason for the future to be identical to the past or present. In fact, it is improbable.

Methods of Projection

Two methods of projection are commonly used. These methods are explained by Clawson and Knetsch (4) in relation to outdoor recreation and are the major methods of econometric projection. The two methods are: (a) simple trend projection based on past use or activity level; and (b) structural analysis, which is extending the trend for the significant underlying factors that influence participation in outdoor recreation and basing future estimates of outdoor-recreation participation on these extensions.

In the actual projection of trends, whether for outdoor-recreation participation or any other variable, a combination of these methods is commonly used. Whatever the method, a large portion of judgment is needed.

Simple trend extension consists of extrapolation from a set of time-series data. Trend extension is generally graphic. The line, as developed for the time series, is simply extended under the appropriate assumptions concerning shape of the curve. The method is based on the limiting assumption that what has occurred in the past is a good indication of the future. If this is not completely true, considerable error and cost may be involved. Another problem with simple trend extension is that information concerning the causal factors of the trend is lacking. The second method of projection may be a partial solution to this problem.

Basing forecasts on projections of causal factors is often called structural analysis. Structural analysis relates a dependent variable to a number of independent variables via regression analysis, or any of a variety of techniques. It differs from simple trend extension in that the causal factors are explicitly recognized. Most of the independent variables are in themselves projections; thus, the prediction problems are shifted from the dependent to the independent variables.

This method depends on three assumptions: (a) the appropriate independent variables (causal factors) can be discovered from among the infinitely large number of possible variables; (b) the relationship between the independent variables and the dependent variable will change at some predetermined rate; and (c) accurate predictions of the future values of the causal factors can be established. The last assumption depends on the reliability of the data on which the predictions are based and the selection of a representative time period for measurement of the factors.

This method has the disadvantage that projections are only as good as the predictions for the future values of the independent variables. Offsetting this is the advantage that, if predictions of causal factors are adequate, the net effect of each change in each factor may be established independently, thus permitting examination of the relationship in detail. This method also makes possible the derivation of projections when no time series is available for trend extension, a rather important advantage in the present situation.

METHOD AND PROCEDURE

The data used in this study were obtained from a survey of Iowa outdoor recreation conducted by the Iowa State University Department of Forestry and the Survey Section of the Iowa State University Statistical Laboratory under Experiment Station Project 1580 in cooperation with the Iowa Conservation Commission. The field work for the Iowa Outdoor Recreation Survey (13) was conducted in October and early November, 1966. The period covered by the questionnaire was from the day after Labor Day, 1965, until Labor Day, 1966.

Collection of Data

The 1966 Iowa Outdoor Recreation Survey[3] was designed in such a way that each person in the state had an equal chance of being selected in the sample. It was thus possible to use a single scale factor to convert sample data to statewide estimates, or regional sample data to provide regional estimates.

A total of 323 segments of expected size "three-housing-units"[4] (occupied and unoccupied) were taken, of which 77 were assigned directly to the seven cities in the state with population greater than 50,000, proportional to the number of housing units in each according to the 1960 census. For the remainder of the universe (all housing units outside the seven cities), cells were formed by using a two-way geographic-zone classification. Counties or pairs of counties formed the 77 geographic breakdowns. The four zones defined were: (a) cities with population between 10,000 and 49,000 according to the 1960 census; (b) towns with population between 2,500 and 9,999; (c) towns with population less than 2,500 (rural places); and (d) the remainder of the state (open country).

The segments for these zones were allocated to the 235 cells (73 of the 208 conceptual cells having no population) proportional to the number of housing units in each. Although rounding error in allocating to individual cells was unavoidable, a technique was used that assured a minimum of rounding error with respect to the marginal distributions.

Within each cell receiving at least one segment in the allocation, one primary (town or township) was drawn with probability proportional to size, and the appropriate number of segments drawn within that primary in a systematic manner. The measure of size varied from zone to zone, depend-

[3]Data from this survey are available from the Iowa State University Department of Forestry.

[4]Each "three-housing-units" consists of three single-family dwelling units, be they houses or apartments.

ing upon the materials used for actually defining the segments. Because the allocation was based on total housing units according to the 1960 census, adjustments were made to maintain the self-weighting characteristics of the sample when switching from census materials to other data, such as photo counts, city directory counts, etc. The over-all sampling fraction for segments was approximately 1 out of 934.

Because the study was concerned with the activities and opinions of individuals, rather than of households, a subsampling scheme was used to select particular individuals to be interviewed. All persons in the segment 12 years old and over were listed, and a systematic sample of two persons out of five was selected for interviewing. The count was carried over from household to household and from segment to segment within an interviewer's assignment. The over-all probability of any individual being selected in the sample was (1/934)(2/5) = 1/2,335. A description of the sample finally selected can be found in Appendix A.

Estimating Population Totals

Since the sample was self-weighting for individuals, estimates of the population means per person are provided by the corresponding simple sample mean (y^*). Estimates of the population totals can be obtained by equation (I).

$$Y = (2{,}335)(858)y^* \qquad (I)$$

where 2,335 is the inverse of the uniform sampling fraction for segments and 858 is the total number of persons selected for interview, of whom 812 actually were interviewed. The latter adjustment assumes that those who did not respond did not differ, as a group, from those who did. The same assumption is implicit in the estimator of the mean. Since the nonresponse rate is reasonably low, the effect of this assumption, even though it may conflict with the facts, probably is negligible.

Dependent and Independent Variables

Among the variables that the Iowa Outdoor Recreation Survey sought to measure were: intensity of participation in various outdoor-recreation activities, preference for various activities, and population characteristics of recreationists.

The dependent variables measured and analyzed in the present study were measures of participation in the recreation activities listed in table 1. Participation in some other activities also was measured. The listed activities, however, comprise those with the most participation and possibly those of most interest and importance to the recreation planner.

Those participants from the State of Iowa may be characterized by the following variables, which are the independent variables of the Iowa Outdoor Recreation Survey: (a) population density of the area in which the respondent's residence is located; (b) sex of the respondent; (c) age of the respondent; (d) size of the respondent's household; (e) educational level of the respondent; (f) family income; and (g) leisure time available and leisure time used by the respondent. The independent variables and their form of measurement are detailed in table 1.

There is a number of ways in which each variable could have been measured. The methods chosen for most will be self-evident from table 1. The exceptions are the dependent variables. These were measured in two ways: (a) Summer participation was measured to the nearest activity day. (b) Activity through the rest of the year was measured as falling into one of three classes of intensity for each activity.[5] Aggregation for the total year was the sum of the summer days plus the midpoint of the appropriate range.

Reliability of Estimates of Variables

The estimates provided by the Iowa Outdoor Recreation Survey may be in error for several reasons (hence, projections derived from these estimates may also be in error). One source of error is reporting error; that is, the respondent simply forgets how many times he participated in a given activity. This error was reduced by taking the survey at the close of the most active season for outdoor recreation and by speaking only of 1-year's activities.

A second source of reporting error is in misunderstanding the question, such as calling an activity by the wrong name. Such errors were held to a minimum by carefully training the interviewers and by the use of precisely worded questions.

Another source of error is in differences in estimates that result simply by chance selection of the respondents. An estimate of the magnitude of variation from this source is available from the sample data. Such an estimate is called the estimated standard error, from which a confidence interval may be computed.

In the estimates of the percentage of Iowa residents participating in any activity, which range from less than 1 percent to 79 percent, depending on the activity, the largest confidence interval is estimated to be less than ± 3.5 percent. Several activities and their confidence intervals are listed in table 2.

It may be seen from table 2 that, although the confidence intervals for those activities with low participation are small in absolute terms, they are large relative to the point estimates. In many cases, only a few more participants would have doubled the estimated amount of participation and reduced the relative error considerably.

[5]The ranges and midpoints are: 1-5 days, midpoint 3 days; 6-10 days, midpoint 8 days; more than 10 days, no formal midpoint, although 13 days was arbitrarily selected as midpoint.

Table 1. Variables used in multiple regression analysis of outdoor-recreation participation a/ in Iowa, Labor Day 1965 to Labor Day 1966.

Variable number	Variable
	Independent Variables
$X_{1.1}$	---- Population density, open country
$X_{1.2}$	---- Population density, towns of less than 2,500
$X_{1.3}$	---- Population density, towns of 2,500 to 9,999
$X_{1.4}$	---- Population density, cities of 10,000 to 49,999
X_2	---- Sex of respondent
X_3	---- Age of respondent
X_4	---- Number of persons in household
X_5	---- Highest grade completed by respondent (education)
$X_{6.1}$	---- Income, under $3,000
$X_{6.2}$	---- Income, $3,000 to $5,999
$X_{6.3}$	---- Income, $6,000 to $7,999
$X_{6.4}$	---- Income, $8,000 to $9,999
$X_{6.5}$	---- Income, $10,000 to $14,999
X_7	---- Leisure time available, average weekday
X_8	---- Leisure time available, average weekend day
X_9	---- Leisure time used for recreation, average weekday
X_{10}	---- Leisure time used for recreation, average weekend day
X_{11}	---- Age, years squared b/
X_{12}	---- Education, years squared b/

Variable number	Variable
	Dependent Variables
Y_1	---- Bicycling, number of days
Y_2	---- Horseback riding, number of days
Y_3	---- Playing outdoor games or sports, number of days
Y_4	---- Playing golf, number of days
Y_5	---- Playing baseball or softball, number of days
Y_6	---- Playing volleyball, number of days
Y_7	---- Fishing, number of days
Y_8	---- Boating, number of days
Y_9	---- Swimming (all types of areas), number of days
Y_{10}	---- Swimming (outdoor pool), number of days
Y_{11}	---- Swimming (in natural environment), number of days
Y_{12}	---- Water skiing, number of days
Y_{13}	---- Hunting, number of days
Y_{14}	---- Camping, number of days
Y_{15}	---- Walking for pleasure, number of days
Y_{16}	---- Bird watching, number of days
Y_{17}	---- Taking nature walks, number of days
Y_{18}	---- Picnicking, number of days
Y_{19}	---- Driving for pleasure, number of days
Y_{20}	---- Sightseeing, number of days
Y_{21}	---- Attending outdoor sporting events, number of days
Y_{22}	---- Attending outdoor plays or concerts, number of days
Y_{23}	---- Motorcycling, number of days
Y_{24}	---- Ice skating, number of days

a/ Activity days per participant - defined as participation in an activity during any calendar day. May be participation for as little as 1 hour. Multiple occurrences in 1 day still constitute 1 activity day.

b/ These variables were used to determine whether consumption reacts in a curvilinear fashion to changes in age and education.

Table 2. Confidence intervals for the percentage of Iowans engaging in selected activities.

Activity	Sample-based estimates (percent)	Confidence interval (percent)
Bicycling	21.7	18.8-24.6
Horseback riding	11.9	9.6-14.2
Fishing	40.7	37.3-44.2
Boating	35.0	31.7-38.4
Swimming (all)	37.9	34.5-41.3
Hunting	18.5	15.8-21.2
Camping	15.1	12.6-17.6
Walking for pleasure	58.6	55.1-62.1
Picnicking	77.7	74.8-80.6
Driving for pleasure	78.7	75.8-81.6
Sightseeing	58.8	55.3-62.3
Attending outdoor sports events	48.3	44.8-51.8
Attending outdoor concerts and plays	18.7	16.0-21.4

Comparisons With Other Surveys

Two other outdoor-recreation surveys have been done, which have some applicability to Iowa: the 1960 ORRRC National Survey (11) and the 1965 Survey of Outdoor Recreation Activities (15). Average participation rates and other statistics were published for the nation as a whole and for each of several regions in each survey. In the 1960 survey, Iowa was one of 11 states in the North Central Region; and in 1965, one of seven states in the western North Central Region.

In deriving figures from these studies for use in Iowa, data from these regions can be assumed more relevant to Iowa than those from other regions. The Iowa interviews for the 1960 and 1965 national surveys did go into the regional averages, too, even though there were only about 80 respondents interviewed in Iowa in 1960. These respondents were all in three counties, and they constituted less than 7 percent of the persons interviewed in the North Central Region. In addition, Iowans' activities are not likely to be very similar to those of the residents of other states in the region. But there was no really better basis for obtaining estimates for Iowa before the 1966 Iowa Outdoor Recreation Survey. Similar restrictions hold for the 1965 national survey, although approximately 150 Iowans were interviewed.

In general, the Iowa Outdoor Recreation Survey provides the best available estimates of the outdoor-recreation activities of Iowans. The sample selected and studied in this survey was drawn from a population consisting of all Iowa residents. These residents are, of course, not the only users (either current or potential) of recreation facilities located in Iowa. This is particularly true in portions of the state readily accessible from major metropolitan areas; e.g., northeast Iowa which is both recreationally attractive and only a few hours from Chicago. Furthermore, a portion of Iowans' recreation activities takes place outside the state. Thus sampling Iowa residents is a simplification. Nevertheless, it contributes to a logical pattern for estimating recreation preferences and use patterns.

An exception to this general statement exists in the case of certain activities for which separate and more intensive studies have been made. For example, estimates of fishing participants are available from an actual count of fishing licenses sold. Such actual counts will be preferred by most users; but because of different definitions and a different way of collecting the data, great caution should be used in comparing such data with the other estimates of the Iowa Outdoor Recreation Survey.

The differences in the results of the two national surveys when applied to Iowa and the results of the Iowa survey may be demonstrated. Applying the regional averages from the 1960 and 1965 national surveys and using the 1966 estimated Iowa population 12 years old and older, comparisons can be made with the direct estimates of the Iowa Outdoor Recreation Survey. These comparisons are shown in table 3.

The general conclusion that can be drawn from these comparisons is that it is very misleading to use data from one time and region to estimate recreation-participation rates for one state of the region at another time. The differences are striking. It would thus seem unwise to discuss differences in 1960 and 1965 estimated from regional data and the results of the 1966 Iowa survey estimates as

Table 3. Comparison of estimated 1966 Iowa outdoor-recreation participation from the Iowa Outdoor Recreation Survey with projected estimated 1966 Iowa outdoor-recreation participation from the 1960 and 1965 national recreation surveys.

Activity	1966 Participants: Iowa survey	1960 natl. survey	1965 natl. survey	1966 Participants: Iowa survey	1960 natl. survey	1965 natl. survey
	thousand persons			million days		
Driving for pleasure	1,576	1,100	1,322	31.2	44.3	16.4
Walking for pleasure	1,758	747	969	20.0	34.1	11.8
Playing outdoor games and sports	746	561	881	12.5	24.3	13.0
Swimming	760	872	903	10.7	11.1	13.2
Bicycling	434	166	485	10.6	10.3	7.9
Fishing	817	478	837	9.1	8.3	6.4
Picnicking	1,557	893	1,520	12.6	7.6	8.8
Horseback riding	239	104	286	3.0	2.2	7.9
Camping	303	166	264	2.0	1.3	1.8

being indicative of trends. The bases are so very different that such comparisons are not likely to be indicative of anything other than the differences in the sample populations from which they were drawn.

Analysis

The hypothesis of this study is that the dependent variables, mean annual days of participation in the various activities, are functions of the several explanatory socioeconomic variables. A general regression model was fitted for all the dependent variables listed. Dependent and independent variables, with labels, have been listed in table 1. An analysis based on the theoretical hypothesis was used to further two objectives. These are: determine which socioeconomic variables affect outdoor-recreation participation in specific activities in Iowa, and provide a basis for projecting future participation in Iowa.

There are several methods by which multiple regressions may be developed. Among these are stepwise regression and computation of all possible regressions. Computation of all possible regressions, though otherwise optimal, has some disadvantages. These are the extremely large number of equations to be computed and the loss of sensitivity of the appropriate tests after this extensive screening because of the highly conditional probabilities.

This study used a modification of the all-possible-solutions method, as developed by Grosenbaugh (8) and further refined by Furnival (7). This method reduces the number of equations computed through the use of four constraints. These are: Some independent variables may be forced to appear in every equation. The maximum number of independent variables to appear in any one equation may be limited to less than the total number of independent variables. The independent variables may be placed in sets such that, if one variable in a set appears, all others in the set will also appear. Variables may be placed in groups such that, if one variable of the group appears, none of the others in the group will appear.

The method just described was used to choose the independent variables for each dependent variable. Within the constraints cited, all possible combinations of variables were computed as the number of independent variables increased from 1 to k. The variables were chosen for inclusion in the final equation by their contribution to R^2 as the number of variables increased. The order in which variables tentatively entered was different for each dependent variable. Thus, for Y_1, the independent variables entered as X_4, X_3, X_{11}, $X_{6.1}-X_{6.5}$, etc.; whereas for Y_2, the order was X_3, $X_{6.1}-X_{6.5}$, $X_{1.1}-X_{1.4}$, etc. Coefficients, standard errors for the coefficients, t values of the coefficients, over-all F, standard error of the estimate R^2, and R were calculated for each equation. [6]

Each variable was tested for significance as it entered the equation. The hypothesis tested was that $\beta_i = 0$. For single-variable sets, this was accomplished by use of the t-test (5, p. 20). This test was run at a significance level (two tailed) of 90 percent. The variables that entered as sets of more than one variable (dummy variables) were tested by an F-test of the increase in the regression mean square as the set was added (12, pp. 387-388). The hypothesis tested, equation (II), was that:

$$\beta_i = \beta_{i+1} = \beta_{i+2} = \beta_{i+n} = 0. \qquad \text{(II)}$$

This again was tested at the 90-percent significance level.

Confidence intervals[7] for selected activities were also established. The confidence interval for the population average value of the jth activity, corresponding to the average values of each in a given set of independent variables, was computed as shown by Draper and Smith (5, p. 122).

RESULTS

Variables Influencing Outdoor Recreation

Some variables have a greater influence on outdoor-recreation patterns and intensity than do others. One way to rank the relative importance of independent variables is by the magnitude of their average partial coefficients of determination, using procedures described by Ezekiel and Fox (6) and Christ (1). When the variables are ranked in this manner (table C-2, Appendix C), age is the most important determinant of outdoor-recreation consumption in Iowa, with a partial coefficient of determination of 0.0582. Age-squared follows with 0.0394. The other variables, in order, are: education-squared (0.0370), education (0.0350), leisure time spent on outdoor recreation on an average weekday (0.0328), sex (0.0282), family income (0.0277), leisure time spent on outdoor recreation on an average weekend day (0.0222), population density of respondent's residence (0.0203), leisure time available on an average weekday (0.0187), and size of household (0.0133).

One leisure variable, time available on an average weekend day, does not appear in any equation. The other time-available variable (weekday) appears only in three equations (driving for pleasure, sightseeing, and attending outdoor plays or concerts) all of which are sedentary activities.

[6] A complete description of each activity's regression, with associated statistics, may be found in Appendix B. Other statistics related to each equation, but not generated concurrently, may be found in Appendix C.

[7] Confidence intervals should be interpreted as follows: If repeated samples were taken (of the same size and at the same values of X_i's used to determine the fitted equations) and in each case a $(1-\alpha)$ level confidence interval was constructed for μ, the population mean of Y, then a proportion $(1-\alpha)$ of the intervals would be expected to contain μ.

Four Types of Outdoor Recreation

Outdoor Recreation Resources Review Commission (ORRRC) Report 19 (11) divides outdoor recreation activities into four general categories, based on the factors affecting the rate of participation. These groups of activities are: active, passive, water oriented, and backwoods. Division of the activities presented in this study into these same four groups results in the patterns shown in table 4.

Table 4. Active, passive, water oriented, and backwoods recreation classifications.

Classification	Activity
Active	Bicycling
	Horseback riding
	Playing outdoor games
	Playing golf
	Playing volleyball
	Playing baseball or softball
	Motorcycling
	Ice skating
Passive	Walking for pleasure
	Bird watching
	Taking nature walks
	Picnicking
	Sightseeing
	Driving for pleasure
	Attending outdoor sporting events
	Attending outdoor plays or concerts
Water Oriented	Fishing
	Boating
	Swimming (total)
	Swimming (in outdoor pool)
	Swimming (in natural environment)
	Water skiing
Backwoods	Hunting
	Camping

Report 19 determines that, for active activities in the North Central Region, age, education, and household size are the most important determinants. In the present study, the results are somewhat the same, with the exception that income also is highly significant.[8]

Discussing passive activities in the North Central Region, Report 19 indicates that age, education, and population density are the important determining variables. The present study agrees in general with these conclusions, again with the exception that income is one of the important variables.

For water-oriented recreation, the report indicates that population density, education, and income are important determining variables; this study finds that age is important, and education not important. The Outdoor Recreation Resources Review Commission Report 19 (11) indicates that age, sex, education, and income are the variables of interest with backwoods recreation. Our study substitutes population density for education.

From the following comparisons, the Iowa recreationists are similar to those of the North Central Region as a whole in their reaction to their own social and economic circumstances. According to this study, the one major difference is that income is a much more important determinant of outdoor-recreation consumption in Iowa than in the North Central Region as a whole. Income in this study may be a stand-in for the variable, occupation of the head of the household. Other studies have found that this variable may be important. Because the Iowa study did not use this variable, the effect of income may be strengthened.

Age

Because age is the most important determining variable, it seems logical that it would tend to show some pattern in its effect on outdoor-recreation participation as it changes. The relationship is one of decreasing participation with age. This holds true in all equations in which age is a significant variable. The effect is strongest, however, in the active and backwoods types of activities, with the relationship seeming to be quite direct.

This is in contrast to the findings of the Outdoor Recreation Resources Review Commission Report 20(9), which finds that, for many activities, an increase in participation may be noted up to and through middle age, then a decline occurs, which might be attributed to a decline in physical energy. When age-squared, the next important variable, is considered in conjunction with age, however, the findings of this study then agree with the Outdoor Recreation Resources Review Commission Report 20 (9).

The generally greater recreation consumption by younger persons may result from a change in the types of recreation that younger people are learning. It may also be because children are increasingly becoming engaged in outdoor activities in Scouts, church groups, and school. We could speculate that, perhaps, when this generation grows older, they will participate in outdoor recreation more than older groups do at present.

Education

Generally, the relationship of education to consumption of outdoor recreation is negative. The regression coefficient for education is negative for two-thirds of the equations in which education appears as a significant variable. As education increases, participation in passive pursuits increases and participation in active, backwoods, or water-oriented activities decreases.

Leisure Time

Where leisure time entered prediction equations, the coefficients were always positive. In no instance does more than one leisure-time variable enter any given equation. This serves to indicate that these variables are so closely correlated as to be interchangeable; the simple correlation between time available and time spent (weekday and weekend day) being 0.245 and 0.372, respectively.

[8] Relative importance of variables was determined by the partial coefficients of determination, which may be found in table C-2, Appendix C.

Sex

The relationship of sex of participant to participation in outdoor recreation is positive in five of seven cases. In active or backwoods activities, males participate to a significantly greater extent than females. In the passive activities, picnicking and sightseeing, the reverse is true.

Family Income

Because family income appears in so many equations, it would seem logical that it would tend to show some pattern in its effect on outdoor-recreation consumption as it changed. In this respect, it is not disappointing, since income generates not one, but two basic patterns of behavior.

The first of these, occurring in eight of 24 activities, is that, as income increases (all other things being equal), outdoor-recreation consumption increases. Explanation for this might be that higher incomes permit the purchase of vacations, trips, and the equipment for outdoor recreation. Another explanation may be that longer, paid vacations are sometimes associated with higher incomes.

The second pattern, occurring in seven of 24 activities, is that, as income increases up to the middle range ($7,999-$9,999), consumption of outdoor recreation increases. As income moves past this range, the consumption of outdoor recreation again decreases. An implication of this pattern, which is at variance with the first, is that persons of higher income may also have responsibilities that limit their leisure time and prevent participation in time-intensive activities. Examination of the results, however, shows no pattern between time intensiveness and the two patterns of income response.

In relation to the first general pattern, there is a strong link to the type of activity. In six of eight cases, activities associated with the first pattern are active. There is no such link for the second income-response pattern.

Population Density

Although there does not seem to be a general trend in the relation of population density to outdoor-recreation consumption, one or two things are evident. These are that activity is quite heavy for residents of towns of less than 2,500 persons (the regression coefficients being positive in 10 of 13 cases) and again in cities of 10,000 to 49,999 (the regression coefficients being positive in 10 of 13 cases, and, in general, the same activities as before). A concomitant observation is that residence in open country nearly always reduces participation in outdoor recreation. These results are, again, largely in accordance with the Outdoor Recreation Resources Review Commission Report 20 (9).

Household Size

There is little definite relationship of household size to consumption of outdoor recreation. In the three instances in which this factor is important, two of the coefficients are positive, and one is negative. There also is no link with type of activity.

Correlation of Variables

The degree of correlation between the independent variables is of interest in examining the results of this study. Such examination should give some indication of the accuracy of the equations and values computed from the equations. In general, the smaller the simple correlation between two independent variables, the better are the predictive qualities of equations including these variables.

The simple correlation matrix for all independent variables used is to be found in table C-1, Appendix C. Tests were made to determine whether independent variables were significantly correlated (at the 95-percent significance level), with the exception of dummy variables and leisure-time variables, where correlation could be expected. The test used was described by Steel and Torrie (12, p. 190). Significant r ranged from 0.1020 for five variables to 0.1045 for all possible variables. Thus, the exact significant r varied slightly from equation to equation because the number of variables included was not constant.

Several general combinations, however, were revealed to be significantly correlated. Specific examples may be found by consulting the correlation matrix in table C-1, Appendix C. In general, household size and age, leisure time and residence in open country, age-squared and income, and age and leisure time were significantly correlated. These significant correlations varied from borderline cases to situations in which r exceeded the significant r by 0.2000 or more.

Ranking of Variables for Specific Activities

The ranking of independent variables for specific outdoor-recreation activities may be found in table 5. This ranking was done by partial coefficients of determination, which may be found in table C-2, Appendix C. The interaction of partial coefficients of determination and number of equations in which specific variables appear is quite evident in this table.

If the activities are divided into active, passive, water oriented, and backwoods, as was previously done, the rankings are of some interest.[9] For instance, active activities show age and age-squared to be very important, and family income is somewhat less important. On the other hand, in passive activities and water-oriented activities, family income is much more important. The importance of leisure time also shows a definite link to activity type. The various leisure-time variables appear only four times in eight equations for active activities, but they appear 12 times in 14 equations for passive and water-oriented activities. Their relative ranking also is much higher in these last equations.

[9]Specific cases may be seen by examining table 5.

Table 5. Relative importance of independent variables[a/] affecting outdoor-recreation participation.

Activity	Rankings[b/] 1	2	3	4	5	6	7
Bicycling	X_3	X_5	X_{12}	X_{11}	X_6[c/]	X_1[c/]	
Horseback riding	X_3	X_{11}	X_9	X_1	X_6		
Playing outdoor games or sports	X_3	X_{11}	X_6	X_1	X_9	X_5	X_2
Playing golf	X_6	X_1	X_{12}	X_4			
Playing baseball or softball	X_3	X_{11}	X_5	X_1	X_6	X_2	
Playing volleyball	X_3	X_{11}	X_6	X_9			
Fishing	X_6	X_2	X_{10}				
Boating	X_9	X_6					
Swimming (all)	X_3	X_{11}	X_6	X_1	X_9		
Swimming (outdoor pool)	X_3	X_6	X_{11}	X_9	X_5		
Swimming (natural environment)	X_3	X_{11}	X_6	X_1			
Water skiing	X_3	X_9	X_6	X_4			
Hunting	X_2	X_3	X_6				
Camping	X_9	X_6					
Walking for pleasure	X_1	X_9	X_3	X_{11}	X_6		
Bird watching	X_6						
Nature walks	X_5	X_6					
Picnicking	X_3	X_2	X_9	X_6	X_{10}		
Driving for pleasure	X_{11}	X_1	X_{10}	X_7	X_4		
Sightseeing	X_6	X_5	X_7	X_2			
Attending outdoor sporting events	X_3	X_6	X_{11}	X_1			
Attending outdoor concerts or plays	X_6	X_1	X_7	X_3			
Motorcycling	X_2	X_3	X_6	X_{11}			
Ice skating	X_3	X_6	X_{11}	X_{10}	X_1		

a/ Variables are defined as: X_1, population density; X_2, sex; X_3, age; X_4, household size; X_5, education; X_6, family income; X_7, leisure available on average weekday; X_9, leisure time spent on average weekday; X_{10}, leisure time spent on average weekend day; X_{11}, age squared; X_{12}, education squared.

b/ Ranking by partial coefficients of determination, which may be found in Appendix C.

c/ X_1 refers to $X_{1.1}$-$X_{1.4}$, X_6 refers to $X_{6.1}$-$X_{6.5}$.

Projection of Outdoor-Recreation Participation

Future consumption of outdoor recreation is heavily influenced by expected changes in a number of socioeconomic variables. Consumption of outdoor recreation was projected for the years 1975 and 1980. Trend extension was used to project the explanatory socioeconomic variables for this period. Structural analysis then combined these projections with the regressions previously developed to project the rates of participation in the various activities. These rates were multiplied by population estimates to achieve statewide totals.

The projections so derived are not the first made for Iowa. Another set was developed earlier, in 1965, by the Iowa Conservation Commission, as part of the State Comprehensive Recreation Plan. This earlier set was developed to meet a planning deadline related to eligibility for federal funds under the Land and Water Conservation Act. Time was short. Therefore, average participation rates for the North Central Region as a whole were applied to Iowa population figures. The study reported here was carried out with financial support from the Iowa Conservation Commission to improve the basis for planning by developing estimates more directly applicable to Iowa. The two sets of projections differ somewhat, as readers examining both will note. The difference is not an inconsistency. Rather, it represents improvement in the basis for estimating Iowans' participation in outdoor-recreation activities.

Projection of Socioeconomic Variables

There are no ready-made projections for socioeconomic variables applicable to Iowa that could be found in a form suitable for this study, except population. The projections necessary (see table 6) were difficult to make, since no real guidelines were present, although, in many instances, parallels could be drawn to projections of similar variables in Iowa that already were made, or could be made, based on available data. In addition, in some instances, the outlook for particular socioeconomic variables seemed identical or very similar to the outlook nationally, in which case projections of the future levels of these variables were readily available.

The difficulties encountered can be illustrated in terms of the proportion of population falling into various population-density classes. The definitions of classes differed in the Census of Population (16) (17) and the Iowa survey (13). As a result, the method of projection was to project the census classes, then to parallel these projections with the projection of the Iowa Outdoor Recreation Survey classes. Such projection required the assumption of a constant relationship between the census classes and the Iowa survey classes. Other variables that required similar treatment were age and education because the Census of Population (16) (17) used the median instead of the mean.

The problem of projecting leisure time available was resolved by changing leisure time available by the national changes projected in the Outdoor Recreation Resources Review Commission Report 23 (10). Such a projection required the assumption that Iowa matches the rest of the United States in workweek, vacation, etc. Leisure time used was projected by the simple expedient of determining what percentage of time available was used in 1966 and assuming that this percentage would be constant over the period of projection. This assumption will not hold; but, given the available information, no other could reasonably be used. Household size, family income, and proportion of males in the population were straightforward trend extensions from the Census of Population (16) (17) data. Age-squared and education-squared were judgment projections. This was necessary because the mean of age-squared or education-squared is not the same as mean-age-squared or mean-education-squared. No similar projections were available elsewhere to draw upon for comparison.

Projection of the population of interest (that is, noninstitutionalized Iowa residents, 12 years of age and older) was derived from the Bureau of Census projections of Iowa population (18). The projections used were the Series 11D projections (table 7). The assumption to these projections was, in general, a high net out-migration from Iowa. This assumption may be consistent with the continuing farm consolidation and rural-to-urban migration to the more highly industrialized states of the East and Far West.

Outdoor-Recreation Participation

The regression equations previously developed were used to compute the estimated outdoor-recreation consumption in 1975 and 1980 (see table 8).

Projections were accomplished by using the calculated regressions and the projections of socioeconomic variables. The procedure was to select the appropriate projected value of the significant determining variables for each activity, insert these values in the regression equation, and calculate the mean days of activity per year per person.[10] After calculating the per-person consumption, the estimates developed for each of the 3 years were expanded to statewide consumption, estimated by multiplying them by the projected Iowa population 12 years and older for the years of interest.

The projections developed for one major activity, playing outdoor games and sports, are relatively useless. This is the result of a high degree of correlation with the three subcategories of playing outdoor games and sports (golf, baseball or softball, and volleyball) investigated in this study. In addition, a number of activities not investigated in the present study are included in the participa-

[10]Before calculating participation, the values of the independent variables (socioeconomic variables) were corrected to the estimate obtained from the total sample to give the best possible estimates of participation.

Table 6. Projection of socioeconomic variables, 1966-1980, for Iowa.

Variable number	Variable description	Estimated value 1966	Projected values 1975	1980
$X_{1.1}$	----- Population density, open country (percent of population in class)	29.1	24.5	24.0
$X_{1.2}$	----- Population density, towns of less than 2,500 (percent of population in class)	15.5	16.3	16.5
$X_{1.3}$	----- Population density, towns of 2,500-9,999 (percent of population in class)	13.6	14.3	14.6
$X_{1.4}$	----- Population density, towns of 9,999-49,999 (percent of population in class)	19.3	20.5	21.0
X_2	----- Sex of population (percent male)	50.6	50.5	50.5
X_3	----- Age of population (average in years)	43.0	42.2	41.9
X_4	----- Household size (average number of persons in household)	3.48	3.52	3.54
X_5	----- Education of population (average years of education)	10.7	11.4	11.8
$X_{6.1}$	----- Family income, under $3,000 (percent of population in class)	17.9	6.0	0.0
$X_{6.2}$	----- Family income, $3,000-$5,999 (percent of population in class)	33.3	28.2	25.7
$X_{6.3}$	----- Family income, $6,000-$7,999 (percent of population in class)	17.9	16.9	16.3
$X_{6.4}$	----- Family income, $8,000-$9,999 (percent of population in class)	13.0	19.0	22.1
$X_{6.5}$	----- Family income, $10,000-$14,999 (percent of population in class)	13.0	22.0	26.5
X_7	----- Leisure time available (average weekday, hours)	3.96	4.25	4.41
X_8	----- Leisure time available (average weekend day, hours)	6.83	6.83	6.83
X_9	----- Leisure time spent on outdoor recreation (average weekday, hours)	0.49	0.52	0.54
X_{10}	----- Leisure time spent on outdoor recreation (average weekend day, hours)	1.37	1.37	1.37
X_{11}	----- Age in years, squared (average)	2225	2150	2100
X_{12}	----- Education in years, squared (average)	123	134	141

Table 7. Projection of total population and population 12 years and older, 1966-1980, for Iowa.[a/]

Variable	Estimated value 1966	Projected values 1975	1980
Total population ---------------------------	2,755,000	2,736,000	2,791,000
Population 12 years and older -------------	2,203,604	2,339,280	2,372,350

a/ Based on U.S. Bureau of Census Series IID projections and an expected decrease in percentage of population 12 years and older to 85 percent by 1980.

Table 8. Projection of outdoor-recreation participation 1975 and 1980, for Iowa. [a]

Activity and variable	Estimated days 1966	Change (percent)	Projected days 1975	Change (percent)	Projected days 1980
Bicycling					
per person	4.802		3.907		3.162
state total	10,582,000		9,140,000		7,501,000
periodic change		-13.6		-17.9	
annual change		-1.4		-3.4	
Horseback riding					
per person	1.340		1.277		1.225
state total	2,953,000		2,987,000		2,906,000
periodic change		1.2		- 2.7	
annual change		0.1		- 0.5	
Playing outdoor games and sports					
per person	5.652		6.339		6.378
state total	12,455,000		14,829,000		15,131,000
periodic change		19.1		2.0	
annual change		2.0		0.4	
Playing golf					
per person	1.003		1.762		2.079
state total	2,210,000		4,122,000		4,932,000
periodic change		86.5		19.7	
annual change		7.2		3.7	
Playing baseball or softball					
per person	2.948		3.027		2.808
state total	6,496,000		7,081,000		6,662,000
periodic change		9.0		- 5.9	
annual change		1.0		- 1.2	
Playing volleyball					
per person	0.807		1.049		1.100
state total	1,778,000		2,454,000		2,610,000
periodic change		38.0		6.4	
annual change		3.6		1.2	
Fishing					
per person	4.139		4.054		4.025
state total	9,121,000		9,483,000		9,549,000
periodic change		4.0		0.7	
annual change		0.4		0.1	
Boating					
per person	2.402		2.479		2.511
state total	5,293,000		5,799,000		5,957,000
periodic change		9.6		2.7	
annual change		1.0		0.5	
Swimming (total)					
per person	4.875		5.869		6.079
state total	10,743,000		13,729,000		14,442,000
periodic change		27.8		5.1	
annual change		2.8		1.0	
Swimming (in outdoor pool)					
per person	2.989		3.731		3.860
state total	6,587,000		8,728,000		9,157,000
periodic change		32.5		4.9	
annual change		3.2		1.0	
Swimming (in natural environment)					
per person	1.807		1.884		1.876
state total	3,982,000		4,407,000		4,451,000
periodic change		10.7		1.0	
annual change		1.1		0.2	
Water skiing					
per person	0.231		0.277		0.297
state total	509,000		648,000		705,000
periodic change		27.3		8.8	
annual change		2.7		1.7	

Table 8. (Con't).

Activity and variable	Estimated days 1966	Change (percent)	Projected days 1975	Change (percent)	Projected days 1980
Hunting					
per person	1.503		1.459		1.387
state total	3,312,000		3,413,000		3,290,000
periodic change		3.1		- 3.6	
annual change		0.3		- 0.7	
Camping					
per person	0.929		1.073		1.158
state total	2,047,000		2,510,000		2,747,000
periodic change		22.6		9.4	
annual change		2.3		1.8	
Walking for pleasure					
per person	9.063		9.414		9.347
state total	19,971,000		22,022,000		22,174,000
periodic change		10.3		0.7	
annual change		1.1		0.1	
Bird watching					
per person	0.690		1.043		1.194
state total	1,520,000		2,440,000		2,833,000
periodic change		60.5		16.1	
annual change		5.4		3.0	
Taking nature walks					
per person	0.793		1.061		1.208
state total	1,747,000		2,482,000		2,866,000
periodic change		42.1		15.5	
annual change		4.0		2.9	
Picnicking					
per person	5.736		6.178		6.424
state total	12,640,000		14,452,000		15,240,000
periodic change		14.3		5.5	
annual change		1.5		1.1	
Driving for pleasure					
per person	14.160		14.639		14.882
state total	31,203,000		34,245,000		35,305,000
periodic change		9.8		3.1	
annual change		1.0		0.6	
Sightseeing					
per person	4.149		4.751		5.211
state total	9,143,000		11,114,000		12,362,000
periodic change		21.6		11.2	
annual change		2.2		2.1	
Attending outdoor sporting events					
per person	4.245		4.764		4.938
state total	9,354,000		11,144,000		11,715,000
periodic change		19.1		5.1	
annual change		2.0		1.0	
Attending outdoor plays or concerts					
per person	0.750		1.033		1.164
state total	1,653,000		2,416,000		2,761,000
periodic change		46.2		14.3	
annual change		4.3		2.7	
Motorcycling					
per person	1.981		2.611		2.775
state total	4,365,000		6,108,000		6,583,000
periodic change		39.9		7.8	
annual change		3.8		1.5	
Ice skating					
per person	0.360		0.441		0.459
state total	793,000		1,032,000		1,089,000
periodic change		30.1		5.5	
annual change		3.0		1.1	

a/ Population consists of noninstitutional Iowa residents, 12 years of age and older.

tion rate for the activity "playing outdoor games and sports." The combination of relatively low R^2 and high correlation between these activities has resulted in erroneous coefficients in the explanatory equation for playing outdoor games and sports. When the three subclasses are totaled, they exceed the rate for playing outdoor games and sports.

Changing Patterns of Outdoor Recreation

The general trend in outdoor-recreation participation for Iowa is upward, more than two-thirds of the activities studied showing upward trends in participation by 1980. Most activities show a relatively mild increase, but several activities show a 50-percent increase in per-person participation by 1980. Among these activities are golf, bird watching, and attending outdoor plays or concerts. All three of these activities are strongly affected by income. Since Iowa income is expected to rise substantially by 1980, the changes in participation found for the three activities could be expected. The reason these activities are so strongly affected by income is not clear. One might hypothesize, however, that participation is correlated with education. These three activities might reasonably be expected to be linked to more highly educated persons. Since the educational level of the state as a whole is expected to increase over the next few years, an increase in participation in recreations such as golf, bird watching, and attending outdoor plays and concerts could very well be expected.

Bicycling, horseback riding, playing softball or baseball, fishing, and hunting, in contrast to the general trend, show a decrease in per-person participation by 1980. Three factors affecting participation in these activities are: family income, education, and population density. Bicycling and playing softball or baseball are negatively affected by the increasing educational level expected by 1980. Horseback riding, fishing, and hunting are affected negatively by increasing income levels; and horseback riding, playing softball or baseball, and hunting are negatively affected by increasing population density. This last effect is perhaps the easiest to explain. The explanation may be that each of these activities requires a fairly large area for greatest satisfaction. Because the population migration in Iowa is largely from rural to urban areas, where such large areas are not available, it is probable that participation in these activities will decrease.

The negative relationships of activities to education and income are somewhat difficult to explain on a logical basis. Perhaps one explanation might be that, as education and income increase, so do job responsibilities. A result of this could be that there is less time available for participation in outdoor-recreation activities. But, if this holds true, why do not all activities decrease with income? It may be hypothesized that the activities negatively affected by increasing income and (or) education are fairly time-intensive, leading to the conclusion that this explanation may be at least partly correct.

The foregoing uncertainty concerning the causes of deviations from the expected trend should in itself serve as a signal to view the projected values for outdoor-recreation participation with caution. In addition, a warning may be obtained from the sample confidence intervals (see table 9), and the quite low R^2 (see table B-1) values obtained for the developed equations.

Table 9. Sample confidence intervals.

Variable	R^2 (percent)	Year	Mean (days)	90-percent confidence intervals (days)
Walking for pleasure ------	11.26	1966	9.063	±4.349
Walking for pleasure ------	11.26	1975	9.414	±4.316
Walking for pleasure ------	11.26	1980	9.347	±4.813
Bird watching -------------	3.26	1966	0.690	±1.713
Bird watching -------------	3.26	1975	1.043	±1.654
Bird watching -------------	3.26	1980	1.194	±1.629

The R^2 values were calculated for all equations. Values for this statistic ranged from a low of 3.2 percent to a high of 33.9 percent. The values for most equations ranged from 15 to 25 percent. In no case is the statistic sufficiently high to give overwhelming faith in the predictions of outdoor-recreation participation. It is quite obvious that some other variables must be sought to explain more of the variation in outdoor-recreation participation.

However low the R^2, the projections derived are the best that could be produced given the present data. As such, they are better than other available projections, being more recent and, because of the quality of the survey, much better than using regional estimates of the Bureau of Outdoor Recreation.

As a further note of caution, the confidence intervals for the estimated mean days of participation should be observed. Confidence intervals were calculated for several dependent variables, for the years 1966-80. These intervals were calculated under the assumption that the equation was completely applicable to all years and that only the mean values of the independent variables will change. Two sample intervals are shown in table 9.

The table shows that the half-width of the confidence interval varies from 3 times to less than half the mean value of the dependent variable. It may also be noted that, as R^2 increases, the width of the confidence interval decreases. If the R^2 increased, it would be possible to be more certain that the correct model for the dependent variable had been chosen. Improved choice of independent variables should, then, increase the probability of choosing the correct model.

Sensitivity to Changes in Parameters

A point that should be of considerable interest to the resource manager is the sensitivity of the projected rates of participation to changes in the variables that influence them. This is of interest because obviously there is considerable uncertainty as to whether these socioeconomic factors will indeed follow the courses projected for them in the present study. The resource manager should be interested in providing enough new investment to meet a reasonable range of possible participation rates. A knowledge of the sensitivity of the activity rates to changes in determining factors should aid in defining the most reasonable range for any given activity.

The method used to examine sensitivity to changes in the determining factors is to seek the elasticity. In this study, the elasticity of all single variable factors is simply the appropriate regression coefficient. In the cases in which second-degree variables (which in this study are age-squared and education-squared) enter the factor sets, elasticity in relation to any specific activity may be found by equation (III):

$$\text{Elasticity}_{\text{para}} = \beta_j + 2\beta_i \text{ (parameter)} \qquad \text{(III)}$$

where β_i and β_j ($i > j$) are the appropriate regression coefficients. Specifically, for age and education, which are the two factor sets in this study that are of interest, the specific formulas are:

$$\text{Elasticity}_{\text{age}} = \beta_3 + 2\beta_{11} \text{ (Age)} \qquad \text{(IV)}$$

$$\text{Elasticity}_{\text{education}} = \beta_5 + 2\beta_{12} \text{ (Education)} \qquad \text{(V)}$$

For family income and population density, which are multivariable factor sets, some indication of sensitivity may be had by holding all other variables constant and changing the income distribution or population distribution. An example of such a procedure for family income follows.

Income is assumed to change to the following percentages in each income group: 1) under $3,000, 0.0 percent; 2) $3,000 to $5,999, 24.1 percent; 3) $6,000 to $7,999, 16.0 percent; 4) $8,000 to $9,999, 22.5 percent; 5) $10,000 to $14,999, 27.0 percent. This change could realistically be the result of rural to urban migration and, hence, of farm consolidation and higher farm incomes. The effect of this change on the activities, golf and picnicking, was investigated. Both activities showed considerable stability in reaction to changing income patterns. The changes were: 1) for golf, 2.079 days per person annually increased to 2.129 days per person annually; 2) for picnicking, 6.424 days per person annually increased to 6.501 days per person annually. Because the change in income distribution was large, it seems that many activities may be stable with relation to changes of income, all other things remaining the same.

FURTHER RESEARCH FOR MORE EFFECTIVE PLANNING

The study reported here provides one useful guideline for outdoor-recreation planning. It is only a start, however. A more thorough understanding of the relationships inherent in recreation behavior is needed to provide a basis for forecasting the number of people who will be served and the level of satisfaction afforded by alternative patterns of new facilities.

The present study has two major weaknesses that indicate a need for further research. First, we have attempted to project future participation in outdoor-recreation activities, using data on such participation for only one point in time. This was unavoidable because the 1966 Iowa Outdoor Recreation Survey was a "first." More direct analysis of trends will be possible as the survey is repeated. Such analysis will combine direct observation of trends in participation and relationships between participation and socioeconomic characteristics of the type developed in this study.

The second major weakness is that participation, instead of true demand, has been measured and forecast. This is a weakness common to all studies of this type. In other words, supply conditions for outdoor recreation are implicitly rather than explicitly considered. This is all right as long as the implications of this treatment are recognized. A procedure that projects participation (rather than true demand) will indicate more participation in the same types of activities for which facilities are already available. The consequence is a tendency to perpetuate the kind of facilities already in place in the areas already best served. Also, some important recreation demands of the population will not be recognized. For example, if only hunting is available and people hunt but do not boat, it will seem that there is no demand for boating, only a demand for more hunting.

The most serious deficiency, then, of studies such as this one is that they do not provide any means of determining how recreation use will respond to changes in supply (and preference)—which is where guidance is most needed.

The important implications of this for demand investigations is that it is impossible to carry out meaningful studies simply by asking people how many times they participated in various outdoor-recreation activities. Further research must consider supply of recreational opportunity.

To be most useful for planning, recreation studies, thus, must consider the effect of both supply and demand factors on recreation participation. Consumption data in the form of participation rates for the population of interest is essential, but interpretation must consider that both supply and demand variables explain these rates. That is to say that emphasis must be placed on determining and explaining patterns of use given a supply of opportunities and certain population characteristics. Such investigations would allow estimates to be made of the consequences of different recreational investments and policies.

Listings of recreation areas, with their characteristics and other inventory data, must be compiled as completely as possible. Some problems of recreational inventory are: standardization of facility measurement, assessment of availability of resources for activities that take place outside organized recreation areas, quality differences and measures, and quantification of measurements.

Future studies of outdoor-recreation participation for Iowa should investigate as wide a spectrum of activities as possible. The interrelationships between types of facility (e.g., public and private) should also be investigated. Suppose, for example, that a particular kind of facility is increased in a given geographic area by a specified amount. The ultimate goal then is to be able to describe the specific effect of this increase on visits to these facilities and to others. Ability to do this would greatly improve planning for outdoor-recreation development.

Another aspect of demand that must be considered is the suppressed demand for certain activities for which facilities are not now available. This sort of demand is often discussed on the level of pure conjecture. More explicit estimates are badly needed. Perhaps such demands can be approximated by observing parallels both for related activities and in other geographic areas.

A final demand item concerns establishment of demand parameters in such a way that useful statements can be made about changes in demand over time. Relationships for recreation demand are not stable. Outdoor recreation is subject to fads and rapid changes in tastes, owing, perhaps, to changes in technology.

The following are proposed as specific recommendations for further research on the human-preferences and use-patterns aspects of outdoor recreation.

1. A more detailed statewide inventory of outdoor-recreation sites, both actual and potential, public and private. Such an inventory should take into account as many of the supply factors previously discussed as can be usefully included.

2. Further surveys of outdoor-recreation participation, such as this and another recently completed. Such studies during the years for which projections were made in this study (e.g., 1975) will provide a systematic basis for checking and improving projections.

3. Empirical studies of the relationships between local opportunity and participation in particular recreation activities. One useful study might be made in central Iowa where reservoirs are being built by the Army Corps of Engineers. It should be possible to inventory the recreation opportunities available in these areas before the dams are built. It also should be possible to determine participation rates for water-based outdoor recreation in these areas before the dams are built. Re-inventory and renewed determination of participation rates after the dams have been built should indicate whether increasing the supply of these forms of recreation will increase demand for them. A similar test could be made for northeastern Iowa, where a pronounced possibility for recreational development exists. As the area is developed by private operators and government agencies, it would seem likely that recreation participation should increase. The extent of this response could be measured by before-and-after comparison.

4. Investigation of the psychological and sociological aspects of preferences to further link consumption to recreation opportunity. These studies would be focused on efforts to effectively measure intensity of preference for particular activities.

5. Development of explicit investment criteria for future investment in outdoor recreation in Iowa.

In addition, studies of ecological and design relationships will contribute greatly to more systematic and effective outdoor-recreation planning and development. These studies would focus (probably in this sequence) on factors causing deterioration of recreation sites; on methods for linking recreational carrying capacity to use rates, soil and vegetation, and types of intensity of management; and on specific carrying capacity relationships for particular kinds of sites.

Such studies would not solve all the difficulties of recreation planning and development. They would, however, go a long way towards rationalizing investment and resource allocation in outdoor recreation in Iowa.

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APPENDIX A

Table A-1. Adjusted distribution of sample persons 12 years of age and older during October 1966, for Iowa, by strata.

	Stratum 1		Stratum 2		Stratum 3		Stratum 4		Stratum 5	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	213	26.2	144	17.7	126	15.5	141	17.4	188	23.2
Male (age in years)										
12-17	14	6.6	10	6.9	8	6.3	5	3.5	11	5.9
18-24	11	5.2	4	2.8	6	4.8	10	7.0	10	5.3
25-44	29	13.6	21	14.6	14	11.1	18	12.8	27	14.4
45-64	45	21.1	25	17.4	15	11.9	19	13.5	20	10.6
65+	10	4.7	15	10.4	8	6.3	6	4.3	14	7.4
Female (age in years)										
12-17	21	9.9	11	7.6	10	7.9	9	6.4	11	5.9
18-24	8	3.8	1	0.7	11	8.7	11	7.8	18	9.6
25-44	34	16.0	9	6.3	22	17.5	23	16.3	32	17.0
45-64	30	14.1	23	16.0	18	14.3	32	22.7	22	11.7
65+	11	5.3	25	17.4	14	11.1	8	5.6	23	12.2
Family Income										
Under $3,000	29	14.0	41	29.7	24	19.7	16	11.6	31	17.1
$3,000-$5,999	97	46.9	49	35.5	33	27.0	35	25.4	48	26.5
$6,000-$7,999	29	14.0	19	13.8	22	18.0	42	30.4	29	16.0
$8,000-$9,999	24	11.6	12	8.7	17	13.9	19	13.8	30	16.6
$10,000-$14,999	20	9.7	14	10.1	18	14.8	23	16.7	27	14.9
$15,000-$24,999	6	2.8	3	2.2	5	4.1	2	1.4	11	6.1
$25,000+	2	1.0	0	0	3	2.5	1	0.7	5	2.8
Education (age 24 years or older)										
8 years or less	59	27.7	51	35.5	20	17.2	20	14.2	34	18.1
9-11 years	16	7.5	13	9.0	9	7.8	20	14.2	25	13.3
12 years	71	33.3	32	22.2	36	31.0	43	30.5	51	27.2
13-15 years	11	5.3	11	7.6	9	7.8	10	7.1	19	10.1
16 years+	5	2.3	10	6.9	5	4.3	15	10.6	14	7.4
No response	0	0	1	0.7	2	1.7	1	0.7	0	0
Age 24 or less	51	23.9	26	18.1	35	30.2	32	22.7	45	23.9
All employed (14 years and older)										
Professional, technical	1	0.5	8	5.6	6	4.8	14	10.0	23	12.2
Farmers, farm managers	60	28.1	5	3.5	0	0	0	0	0	0
Managers, officials, proprietors	4	1.9	16	11.1	4	3.2	5	3.5	7	3.7
Clerical	2	0.9	5	3.5	9	7.1	4	2.9	16	8.5
Sales workers	1	0.5	3	2.1	6	4.8	5	3.5	13	6.9
Craftsmen, foremen	8	3.8	8	5.6	9	7.1	12	8.5	15	8.0
Operatives	7	3.3	13	8.9	9	7.1	15	10.6	15	8.0
Service, private household workers	0	0	11	7.6	6	4.8	16	11.3	8	4.3
Unskilled labor	9	4.2	6	4.2	2	1.6	3	2.2	1	0.5
Retired	6	2.8	11	7.6	11	8.7	5	3.5	11	5.9
Students	36	16.9	24	16.7	21	16.6	22	15.6	28	14.9
Housewives and homemakers	78	36.6	32	22.2	42	33.4	38	27.0	47	25.0
Unemployed	1	0.5	2	1.4	1	0.8	2	1.4	4	2.1
Size of Family										
1-2 persons	58	27.2	70	48.6	43	34.2	58	41.1	80	42.6
3-4 persons	86	40.4	39	27.1	41	32.5	50	35.5	55	29.2
5+ persons	69	32.4	35	24.3	42	33.3	33	23.4	53	28.2
Family status										
Respondent married; no child	50	23.5	46	31.9	35	27.8	50	35.4	51	27.1
Respondent married; youngest child 5 or less	46	21.6	14	9.7	30	23.8	19	13.5	42	22.3
Respondent married; youngest child 6-11	26	12.2	16	11.1	15	11.9	14	9.8	17	9.0
Respondent married; youngest child 12 or older	31	14.6	13	9.0	9	7.1	23	16.3	13	6.9
Respondent not married; 17 years or younger; youngest child 5 or less	9	4.2	7	4.9	8	6.3	3	2.1	2	1.1
17 years or younger; youngest child 6-11	10	4.7	5	3.5	3	2.4	4	3.2	7	3.8
17 years or younger; youngest child 12 or older	16	7.5	8	5.6	7	5.5	7	4.8	13	6.9
18 years or older	25	11.7	35	24.3	19	15.1	21	14.9	43	22.9

APPENDIX B

Table B-1. Equations (coefficients) and related statistics for predicting yearly per-capita outdoor recreation c/ in Iowa.

Variable number a/	Bicycling	Horseback riding	Playing outdoor games	Golf	Baseball or softball	Volleyball	Fishing	Boating	Swimming (total)	Swimming (outdoor pool)	Swimming (natural environment)	Water Skiing	Hunting
	ACTIVITY							ACTIVITY					
X_0 ---------	71.2047	6.8079	42.2476	2.6358	26.8560	7.7217	-0.5544	2.0321	29.7689	23.1220	10.0194	0.9512	1.2527
$X_{1.1}$ ---------	-0.2234	0.9029	-2.2420	-0.5938	-0.6270				-1.0158		-0.0518		0.4638
$X_{1.2}$ ---------	4.2039	1.2971	2.9988	2.5381	1.2467				-0.6479		-0.0420		1.1828
$X_{1.3}$ ---------	1.6417	-0.3844	-3.1297	0.9713	-2.0712				3.3222		0.9951		-0.0509
$X_{1.4}$ ---------	2.4412	0.9012	1.3489	-1.0259	1.4555				1.4629		0.0675		0.5179
X_2 ---------			2.4117		1.9073		2.9164						2.6644
X_3 ---------	-0.9699	-0.2945	-0.9483		-0.7253	-0.2517			-1.0908	-0.7368	-0.2469	-0.0153	-0.0528
X_4 ---------				0.3664								-0.1135	
X_5 ---------	-7.6474		-0.5878		-0.6603					-0.3886			
$X_{6.1}$ ---------	-0.3539	0.1868	-8.5828	-5.1140	-1.1640	-1.5610	0.0776	-1.6472	-1.7356	-1.0612	-1.7561	0.1509	1.2050
$X_{6.2}$ ---------	1.4192	0.7844	-9.1894	-4.8543	-0.9777	-1.3727	4.5413	0.6959	-1.3466	-1.0709	-1.6793	0.2667	1.1632
$X_{6.3}$ ---------	3.4219	1.0152	-6.3089	-5.1782	1.4628	-1.4894	2.6445	-0.3594	0.6226	1.6340	-1.5272	0.0106	1.0619
$X_{6.4}$ ---------	4.8603	0.9965	-8.8489	-5.7971	0.1751	-1.7160	3.4470	-0.9416	-0.4522	0.0017	-1.4130	-0.0199	0.4610
$X_{6.5}$ ---------	6.3511	-0.5032	-4.1474	-1.3059	0.8027	-0.0107	-0.0399	-0.1307	4.7929	6.8510	-2.4571	0.7251	0.0659
X_7 ---------													
X_9 b/ ---------		0.7174	1.2269			0.2742							
X_{10} ---------	0.5460						0.5528	0.4389	0.5385	0.5196		0.0931	
X_{11} ---------	0.0080	0.0025	0.0074		0.0061	0.0023			0.0095	0.0065	0.0018		
X_{12} ---------	0.2851			0.0118									
Standard error	13.1433	6.7737	11.7340	5.2881	8.6383	3.6685	8.4192	5.1716	10.2940	9.5770	4.6881	1.2727	4.2828
Over-all F	12.9391	3.0439	11.3138	5.7732	9.8987	8.0428	5.5511	4.7066	14.5661	12.7786	5.9116	5.2365	5.5225
R^2	0.3391	0.0933	0.3097	0.1514	0.2666	0.1520	0.0974	0.0726	0.3299	0.2431	0.1545	0.1045	0.1458

a/ All coefficients shown were significant at the 90-percent level.
b/ X_8 not included in any equation.
c/ By those 12 years old or older.

Table B-1. (Cont'd).

Variable number a/	Camping	Walking for pleasure	Bird watching	Nature walks	Picnicking	Driving for pleasure	Sightseeing	Attending outdoor sporting events	Attending outdoor plays & concerts	Motor-cycling	Ice skating
X_0 ---------	-0.4649	25.7376	1.5385	-2.2121	12.1877	17.5815	1.2056	17.1288	1.3671	6.9342	1.9969
$X_{1.1}$ ---------		-4.6028				-1.0217		0.6466	0.5469		-0.0526
$X_{1.2}$ ---------		2.7624				3.9109		1.4443	1.4848		-0.0632
$X_{1.3}$ ---------		-2.6766				5.9801		-0.1593	0.6446		-0.1005
$X_{1.4}$ ---------		3.9250				1.0486		-0.0655	0.4364		-0.0860
X_2 ---------					-2.1605		-1.5249			3.0910	
X_3 ---------		-0.6887			-0.0837			-0.3801	-0.0155	-0.3316	-0.0924
X_4 ---------						-0.9326					
X_5 ---------				0.2086			0.3839				
$X_{6.1}$ ---------	0.2404	0.6939	-1.3797	0.4663	-3.9519		-2.8712	-4.2439	-1.2458	0.7766	0.2972
$X_{6.2}$ ---------	0.9835	-0.4711	-1.2644	0.4916	-2.9876		-1.4862	-3.5461	-1.2732	1.5436	0.3189
$X_{6.3}$ ---------	1.0656	-3.3349	-1.2002	0.6295	-2.7854		-2.3341	-1.7267	-1.0086	0.7793	0.5970
$X_{6.4}$ ---------	2.1177	-3.1689	-0.0176	1.5272	-1.4171		1.5519	-2.1943	0.1064	3.1348	0.1110
$X_{6.5}$ ---------	1.0744	0.9617	0.6811	1.3792	-1.7795		-2.0860	-2.0271	-0.1950	4.3282	2.6954
X_7 ---------						0.6545	0.2563		0.0917		
X_9 b/ ---------	0.8222	2.4026			0.8323						
X_{10} ---------					0.2868	0.9505					0.0615
X_{11} ---------		0.0060				-0.0024		0.0027		0.0028	0.0008
X_{12} ---------											
Standard error	3.0202	17.7445	3.9250	3.5718	6.8043	14.9836	6.4351	7.3144	2.1315	10.9504	1.4997
Over-all F	9.4898	3.7537	2.4402	2.7273	7.7913	5.8822	4.6985	6.7999	4.3146	3.3011	5.4797
R^2	0.1362	0.1126	0.0326	0.0434	0.1638	0.1159	0.0948	0.1736	0.1176	0.0685	0.1563

APPENDIX C

Table C-1. Simple correlation matrix.

Variable	$X_{1.1}$	$X_{1.2}$	$X_{1.3}$	$X_{1.4}$	X_2	X_3	X_4	X_5	$X_{6.1}$	$X_{6.2}$	$X_{6.3}$	$X_{6.4}$	$X_{6.5}$	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
$X_{1.1}$ ------	1.000																		
$X_{1.2}$ ------	-0.274	1.000																	
$X_{1.3}$ ------	-0.254	-0.170	1.000																
$X_{1.4}$ ------	-0.313	-0.209	-0.193	1.000															
X_2 ------	0.053	0.017	-0.011	-0.017	1.000														
X_3 ------	-0.050	0.153	-0.016	-0.046	-0.050	1.000													
X_4 ------	0.142	-0.076	-0.010	-0.036	0.150	-0.486	1.000												
X_5 ------	-0.108	-0.021	-0.059	0.108	-0.058	-0.067	-0.044	1.000											
$X_{6.1}$ ------	-0.021	0.105	0.051	-0.149	-0.096	0.349	-0.275	-0.138	1.000										
$X_{6.2}$ ------	0.133	-0.030	-0.022	-0.029	0.020	-0.026	-0.026	-0.132	-0.346	1.000									
$X_{6.3}$ ------	-0.120	-0.010	-0.046	0.193	0.030	-0.071	0.049	0.088	-0.216	-0.362	1.000								
$X_{6.4}$ ------	0.019	-0.010	-0.012	-0.067	-0.029	-0.182	0.147	0.075	-0.176	-0.295	-0.183	1.000							
$X_{6.5}$ ------	-0.018	-0.032	0.011	0.068	0.094	-0.097	0.154	0.124	-0.161	-0.270	-0.169	-0.137	1.000						
X_7 ------	-0.122	0.050	-0.027	0.016	-0.105	0.247	-0.261	-0.124	0.177	0.070	-0.116	-0.131	-0.031	1.000					
X_8 ------	-0.153	0.025	-0.110	0.078	0.012	0.019	-0.044	-0.052	0.002	0.059	0.090	-0.139	-0.061	0.400	1.000				
X_9 ------	0.030	-0.064	0.026	-0.003	-0.083	-0.157	0.073	-0.043	-0.035	-0.054	-0.054	0.043	0.114	0.245	0.045	1.000			
X_{10} ------	-0.066	-0.080	-0.076	0.169	-0.034	-0.191	0.129	-0.013	-0.117	-0.072	0.115	-0.009	-0.057	0.064	0.372	0.176	1.000		
X_{11} ------	-0.053	0.165	-0.011	-0.061	-0.061	0.977	-0.502	-0.142	0.399	-0.028	-0.092	-0.197	-0.111	0.291	0.057	-0.125	-0.168	1.000	
X_{12} ------	-0.117	-0.007	-0.068	0.113	-0.055	-0.077	-0.052	0.983	-0.133	-0.139	0.080	0.066	0.141	-0.118	-0.041	-0.031	-0.005	-0.145	1.000

Table C-2. Partial coefficients of determination of independent variables to dependent variables.

Activity	Independent Variable $X_{1.1}$ - $X_{1.4}$	X_2	X_3	X_4	X_5	$X_{6.1}$ - $X_{6.5}$	X_7	Independent Variable X_9	X_{10}	X_{11}	X_{12}
Bicycling ------------------------	0.0153		0.0814		0.0811	0.0241				0.0455	0.0566
Horseback riding -----------------	0.0073		0.0300			0.0053		0.0170		0.0180	
Playing outdoor games or sports --	0.0309	0.0103	0.0879		0.0162	0.0337		0.0165		0.0442	
Playing golf ---------------------	0.0482			0.0144		0.0683					0.0174
Playing baseball -----------------	0.0175	0.0120	0.0959		0.0370	0.0121				0.0557	
Playing volleyball ---------------			0.0710			0.0209		0.0085		0.0469	
Fishing --------------------------		0.0289			0.0490				0.0266		
Boating --------------------------						0.0271			0.0438		
Swimming (all) -------------------	0.0203		0.1557			0.0330			0.0162	0.0994	
Swimming (outdoor pool) ----------			0.0800		0.0108	0.0598			0.0177	0.0509	
Swimming (natural environment) ---	0.0055		0.0445			0.0083				0.0183	
Water skiing ---------------------			0.0330	0.0158		0.0245			0.0279		
Hunting --------------------------	0.0089	0.0884	0.0477			0.0095					
Camping --------------------------						0.0323		0.1052			
Walking for pleasure -------------	0.0335		0.0241			0.0079		0.0275		0.0143	
Bird watching --------------------						0.0326					
Nature walks ---------------------					0.0249	0.0131					
Picnicking -----------------------		0.0244	0.0462			0.0172		0.0222	0.0108		
Driving for pleasure -------------	0.0263			0.0096			0.0194		0.0241	0.0545	
Sightseeing ----------------------		0.0136			0.0257	0.0430	0.0173				
Attending outdoor sporting events-	0.0057		0.0434			0.0191				0.0171	
Attending outdoor concerts or plays	0.0439		0.0166			0.0577	0.0193				
Motorcycling ---------------------		0.0195	0.0150			0.0114				0.0083	
Ice skating ----------------------	0.0006		0.0588			0.0492			0.0101	0.0391	
Average coefficient --------------	0.0203	0.0282	0.0582	0.0133	0.0350	0.0277	0.0187	0.0328	0.0222	0.0394	0.0370
Number of equations	13	7	16	3	7	22	3	6	8	13	2

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