Minnesota

DEPARTMENT OF NATURAL RESOURCES

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Regional Recreation Modeling

SCORP

Research and Policy Section

eau of Comprehensive Planning & Progamming

REGIONAL RECREATION PARTICIPATION MODELING

Compiled

for

The Minnesota Department of Natural Resources

Bureau of Planning

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by

William Anthony

Institute of Outdoor Recreation and Tourism

Utah State University

Logan, Utah

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One of the obligations of the Institute of Outdoor Recreation and Tourism (IORT) as a consultant to the Minnesota Department of Natural Resources pursuant to contract 330233 entitled A Survey of the Outdoor Recreation Participation of Minnesota Residents is to develop regional equations for each specified winter and summer recreation activity that can be used to estimate the number of recreation occurrences for any year through 1995 by activity, region of origin and region of participation. The purpose of such a simulatable modelling system is to provide recreation planners with a management tool which will enable them to test the responsiveness of recreation patterns to changes in the parameters and variables which load significantly on the various regression equations which help explain the variation in regional recreation participation levels. Of course, it is desirable to include variables which are relevant and manageable by recreation resource planners in order to permit them to make assumptions concerning recreation resource development programs, population trends and so forth, and then to test the effects of these assumptions on regional recreation patterns.

In constructing and implementing such a modelling system, it is also important to keep it as simple and straightforward to operate and maintain as possible. That is, given that a lesser complicated system is as reliable as a more complicated system. Not only does this reduce the developmental costs which are only one time expenditures, but it also reduces the on going operational and maintenance expenses. Such a system is also easier to work with and therefore, is a more effective management tool.

IORT plans to develop and evaluate on en experimental basis, initially, at least two, and possibly three approaches to the modelling task. These consist of a 1) gravity flow model and 2) Elsner's origin/destination approach. Both have been successfully developed and implemented before. A third approach utilized by C.R. Parent in evaluating the ski resourt industry in Utah is much more demanding in its data requirements, a more involved modelling process and perhaps, not totally appropriate for the task at hand.

Of crucial importance to any modelling project is the data base from which it is developed. Therefore, prior to discussing any further the various modeling methodologies, we shall address the current status of the data base.

DATA BASE

The data base for the modelling project will consist of both primary data collected in the participation surveys and secondary data obtained from various organizations and publications.

Primary Survey Data: Currently most of the primary data necessary for the modelling of winter activities is now on a computer file. While most of the data cleaning is completed, we have found such errors as the inclusion of children aged 0-5 which were not supposed to be included in the survey. These corrections should be made by the end of the week of August 4, 1978. At that time, we will be able to pull out of the file the Winter recreation participation occurrences by activity, by region of destination and by region of origin. In addition, we will be able to run some crosstabulations with various population characteristics which should provide much direction for the ensuring model development.

Secondary Data: Most of the data pertinent to the modelling assignment has been obtained from various federal and Minnesota state government agencies, the University of Minnesota and representative recreation industry organizations.

a) Population Characteristics - The Minnesota Analysis and Planning System, University of Minnesota has provided us with population forecasts by age group and sex for the years 1975, 1980, 1985, 1990 and 1995. We requested this data on June 16, 1978 and received it on data cards just about exactly one month later. We have since written a program to sort and aggregate it into a form suitable for our needs and it is essentially ready for use. The fact that the data is made available only on five year intervals into the future means that the user will either have to extrapolate or make some population trend assumptions in order to obtain annual forecasts or work with five year increments.

In estimating and forecasting recreation participation occurrences, other population characteristics such as income levels, occupation, etc. would probably prove useful. However, this type of information projected into the future beyond a few years is non-existent due to its unreliability. This forces us to rely on the age/sex projections for the modelling project.

b) Recreation Resource Data - The Minnesota Department of Natural Resources has provided us with SCORP inventroy data. We requested this on June 5, 1978, but due to a turnover in perso nel we did not receive the data printout until July 27, 1978. We have since key punched the data and it is essentially ready to use.

We have also obtained ski resort data from a publication titled Minnesota Winter Guide published by the Tourism Division, Minnesota Department of Economic Development and the Parks and Recreation Division, Minnesota Department of Natural Resources. This data has been coded and punched and, also, is ready to use.

c) Other Resource Data - The Minnesota Land Management Information Center (MLMIS) has provided us with other measures of resource availability on a county and regional level. These variables include ownership, highest recommended use, land use, water orientation and highway orientation. We requested this data on June 9, 1978 and received the data deck about July 17, 1978. We have since written a program to sort and aggregate the data into a form compatiable with our data base. It is almost in a shape ready to use.

d) Inter-Regional Travel Distance/Time - MLMIS has also provided us with a enclidean distance matrix containing the linear distances based on longitudianl and latitudinal corrdinates between the population centers of each county and the geographic centers of each region. We have since reduced this to a inter regional distance matrix based on weighted population centroids and regional reographic centroids. In addition, based on the five year projected population trneds, we have developed this matrix for the years 1978, 1980, 1985, 1990 and 1995.

Of probably more relevance to the modelling of recreation flows would be a similar matrix consisting of highway travel times between regional population centroids and regional geographic centroids and regional geographic entroids. On June 9, 1978 we requested the SCORP

Surveys office, Minnesota DNR to procure this information for us from the Minnesota Department of Transportation. As of July 31, 1978, we have not received it. Upon receipt, we will weight it and project it as we did the previous matrix (of course, there is no way to anticipate how new highways would alter this matrix over the relevant modelling projection period. This is something that would have to be updated as the time came).

e) Other Data - Essentially, this is the data we need to accomplish the modelling task. Should this data not suffice to develop reliable estimation equations, we will have to consider new data types of possible, or reconsider the forecasting approach. Parent's approach, for example, for modelling the ski resort industry in Utah required such information as interest rates, per capita personal income, wage rate for serive employees, skier attendance, advertising expenditures, snow conditions and other variables which currently are not available. These will present a problem for utilizing this approach for the long range forecasting task of this project.

MODELLING METHODOLOGIES

As stated previously, IORT will evaluate two approaches to determine which will most satisfactorily perform the modelling operation. These are the 1) Gravity Flow Model and 2) Elsner Oregen/Destination Model.

Gravity Flow Model: This method requires that a regression function based on cross sectional data be developed to estimate recreation occurrences in each region for each acitivty. This implies that there will be one regression equation for each winter and summer activity that is to be forecasted.

The dependent variable will be:

<u># total recreation occurrences/activity/region</u>

The independent variables will be selected from among the following:

a) <u>resource capacity/typology in each destination region</u> - this will consist of SCORP data, ski indistry data, and MLMIS resource data.

b) <u>resource capacity/typology in neighboring competing regions</u> - the same data as in (a) aggregated into bordering and non-bordering regions.

c) <u>population by age/sex in each destination region</u>

d) <u>population by age/sex in 25 mile bordering zones of each region</u>- there will be five bordering zones around each region.

1) 0 - 25 mile
2) 26 - 50 mile
3) 51 - 75 mile
4) 76 - 100 mile
5) remainder of state.

This modelling approach is probably the easiest to develop and use. It has been used successfully in many management applications. If there are 25 winter and 25 summer activities to be forecasted, the total system will consist of 50 equations which will forecase activity occurrences in each destination region based on population and recreation resource characteristics in and around that region. If DNR also wished to forecast the # of occurrences originating in each region, 50 more equations will be required bringing the system total to 100.

This approach will probably be utilized to generate the winter activity forecasts for 1980, 1985, 1990 and 1995 that the contract calls for on September 15, 1978. This will provide a good opportunity to evaluate this method.

Elsner Origin/Destination Approach: This method successfully developed and implemented in modelling user patterns for the commercial ski industry in California. This method requires two modelling steps.

a) Estimation of Recreation Occurrences Originating in Each Region - In this step, we will use cross-sectional data to develop regression functions which will explain the variation in recreation participation originating in each region for each activity. There will be one regression for each specified activity. In other words, if there are 25 winter and 25 summer activities to be forecasted, this step in the system will required 50 equations.

The dependent variable will be:

a) # of activity occurrences origniating in each region

or,

b) # of per capita activity occurrences orginiting in each region = variable(s) above/regional population.

The independent variables will be selected from among the following:

a) Activity Resource Availability = $\frac{\text{Resource Cap}}{\text{Distance}}$;

in which resource capacity for each destination region is measured (i.e. miles of shreline, # boat launchings, etc.) and divided by the distance (either highway travel minutes or euclidlian linear distances) between the origin region population centroid and distination region geographic centroid, and these summed to obtain a measure of resource availability for each origin region.

Of course, this would have to be calculated for each 5 year forecast (or annual forecast) and recalculated with each change of assumption concerning resource development that the planner makes.

b) Origin region population by sex/age

b) Regional Allocation of Activity Consumption - In this step we will develop a regression function to estimate the allocation of each origin regions activity occurrences to each of the 13 destinations regions. One regression will be required for each origin region for each acitivity. Thus, for .50 activities, this step of the system could require 650 seperate regressions (13 regions x 50 activities). However, we may be able to reduce this to 50 equations by pooling all the data for each seperate activity (instead of having 13 observations for each regression, we would have 169 [13 x 13]. This, in fact may be a desirable way to go, although it suffers the consequence of requiring its own separate data base.

The dependent variable is step (b) will be: % of total recreation activities originating in region; occurring in region;

The independent variables will be selected from among the following:

a) resource capacity in the distination region

b) travel time/distance from the origin region population centroid to the destination region geographic centroid

Finally, after developing all of the necessary regressions and obtaining the distribution patterns of activities originating in a given region, these percentages will be applied to the estimated number of activity occurrences in order to arrive at the activity participations occurring in each destination region.

In summary, the Elsner approach is more involved than the gravity flow approach. Both are interesting and local from a recreation flow standpoint. One approach may not work for all activities, so we may in fact need to rely on both. It should be interesting comparing the two approaches.

From a timing perspective, if all goes well with the summer survey, we should be able to meed our deadlines:

September 15, 1978 - winter survey projections

April 1, 1979 - summer survey projections

June 1, 1979 - computer model system

As we move along in the modelling phase, we will be looking to you for input concerning methodology decisions.