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SIMULATION OF THE PUBLIC OUTDOOR RECREATION SECTOR: A TOOL FOR STATEWIDE RECREATION PLANNING

by

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INTRODUCTION

The Outdoor Recreation Resources Review Commission, established by Congress, assigned a key role in recreational resource development to state governments and in particular to an agency that would serve as a focal point for outdoor recreation considerations (5, p. 137). The ORRRC suggested that, if states were to discharge their responsibilities as major suppliers of outdoor recreation services, they "must clearly intensify their current activities" (5, p. 139). However, legislative and appropriating bodies have not, in the past, encouraged managing agencies to look ahead, and often legislators have not provided the financial resources needed to develop recreation plans. Consequently, recreation planning, in nearly every state, has been weak, and in some states, nonexistent (2, p. 292). Clawson and Knetsch assert "planning and research in outdoor recreation lag far behind current needs" (2, p. 289).

Consistent with these views, the primary objective of an Iowa State University study was to design a model which:

1. incorporated and explained the relationship among economic units concerned with public outdoor recreation, and,

2. through changes in parameters in the model and the delineation of time paths of key variables, would be useful for planning purposes (1).

The first section of this paper is a discussion of model design (objective 1), the second section is a brief discussion of the application of the model in statewide recreation planning (objective 2).

A MODEL OF IOWA'S PUBLIC OUTDOOR RECREATION SECTOR

Iowa's public outdoor recreation sector, as defined in this study, included the following economic units: recreationists, the Parks Section of the Iowa Conservation Commission, and the Iowa General Assembly. The Conservation Commission was selected as the focal point agency because it controls the majority of general recreation areas furnished by the state of Iowa, and it participates in both federal and county level public outdoor recreation programs. All funds used by the Parks Sections for maintenance, operations, and capital improvement of state parks and recreation areas are appropriated by the Iowa General Assembly and supplemented by Federal grant-in-aid programs (4, p. 163).

The essential elements and logical sequence of the public outdoor recreation sector model for a two-park case are presented as Figure 1. As indicated, the model was constructed with three basic components corresponding to the three specified economic units.[1]

The logical sequence of the model will be more apparent after explanation of three features: the park quality index, the relevant time interval, and the Parks Section decision process.

Park Quality Index. The park quality index was the result of a "standard of desirability" rating project of the Parks Section (3). Three members of the Parks' staff independently rated each state park in Iowa with respect to

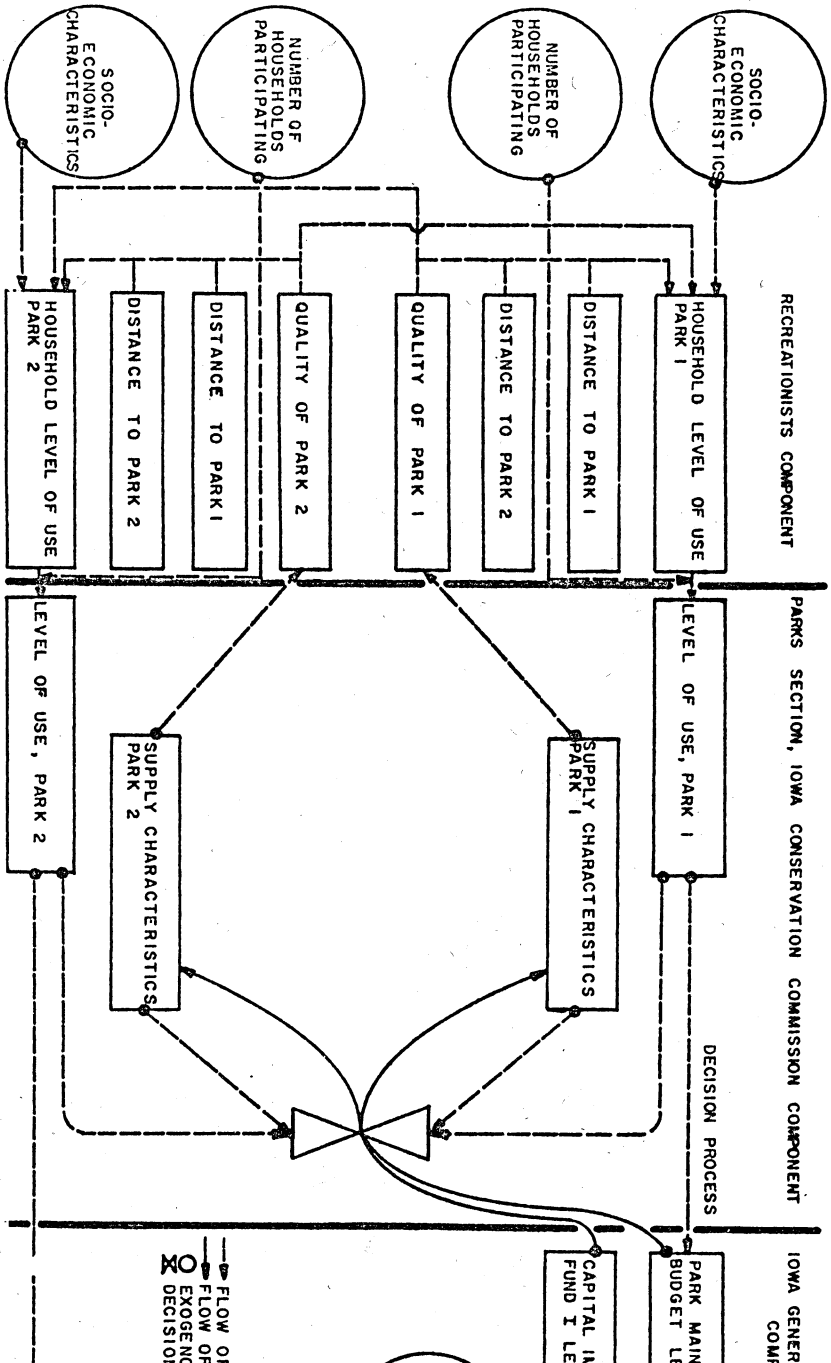

Figure 1. Flow diagram of the two-park model

physical and aesthetic quality, recreation possibilities, size, adequacy of facilities, adaptability to further development, and possibility of expansion. The score for each of these items, by park, is the average of the scores assigned by the three evaluators. The recreation possibilities score is the sum of the parks recreation activities (swimming, boating, fishing, etc.) scores. Park quality (QS_j) is defined as the sum of the park's physical and aesthetic quality, recreation possibility, size, and facilities scores.

Time Interval. A major premise in describing the actions of and interactions among the specified units is that the investment decision process of the Parks Section exhibits an information-feedback effect. Specifically, investment by this public agency in a particular site will influence the use level of that site and will in turn influence future investment decisions. To identify this effect in the discussion of the two-park model, consider a time interval of one year beginning opening day of the park season and ending the day before the next park season. Implicit in defining this time interval is the assumption that site use in a given year t occurs on facilities available at the end of year t-1. This assumption is consistent with the Parks Section practice of scheduling major construction or maintenance projects for the off season.

The Decision Process. The Parks Section decision process is the pivotal element in the model, receiving information from the recreationists component, utilizing information on park supply characteristics from within the Parks Section component, and serving as the regulatory mechanism for the flows of capital improvement and maintenance funds. Decision rules are specified for two categories--maintenance expenditures and capital improvement investments. Three capital improvement items considered were activity areas, facilities, and land. The decision process, as specified in the model, involves two steps: 1) the determination of item expenditure requirements, and 2) the specification of actual levels of investments and expenditures by park. For example, Figure 2 illustrates the process for determining activity area expenditure requirements. Initially, this process involves a series of decisions relative to considering investment in a park. Criteria for consideration are: 1) park activity areas offer less than a high degree of satisfaction to users, as evidenced by the recreation possibility score, 2) the ratio of level of use to rated capacity (intensity of use) is above a specified minimal level,[2] and 3) the park has sufficient undeveloped land within its boundaries for the expansion of activity areas, as evidenced by the parks' adaptability to further development score. As indicated, if one of these criteria is not met the park is not accepted for investment consideration, hence, the activity requirement for that park is set at zero.

As indicated in Figure 2, if the park is accepted for investment consideration "desired" activity area sizes are computed using Parks Section specified standards and information about park level of use. The actual activity area sizes for the two least satisfactory activities, as evidenced by the activity scores, are compared with the corresponding "desired" activity area sizes. If the desired size is significantly greater than the actual size, it is assumed a deficiency in activity space is the basis of the low score. In this case, the capital requirement for expanding the relevant activity area is computed. When the desired size is less than or equal to the actual size it is assumed conditions within the activity area are such that the activity score is low. Hence, a capital requirement for improving the area is computed. A similar procedure is followed in specifying land and facilities investment opportunities and in determining these requirements. Maintenance requirements for repair and replacement of facilities and for labor, are computed for each park.

The second step in the decision process involves balancing the maintenance and capital improvement budgets for the entire park system. If the park system maintenance requirements are greater than the maintenance budget, the labor requirement for the park with the lowest level of use is eliminated and requirements are again checked against the budget. This process continues, eliminating park labor requirements in ascending order of use level, until the budget is balanced. When a balance is achieved, the repair and replacement requirements of all parks and the labor requirements of parks not eliminated are considered maintenance expenditures. In the case of capital improvement items the facilities requirement is eliminated for the lowest use level parks, in ascending order, until a balance is achieved. The remaining park capital improvement requirements are then considered investments. Both balancing processes reflect the system of priorities specified by the Parks Section.

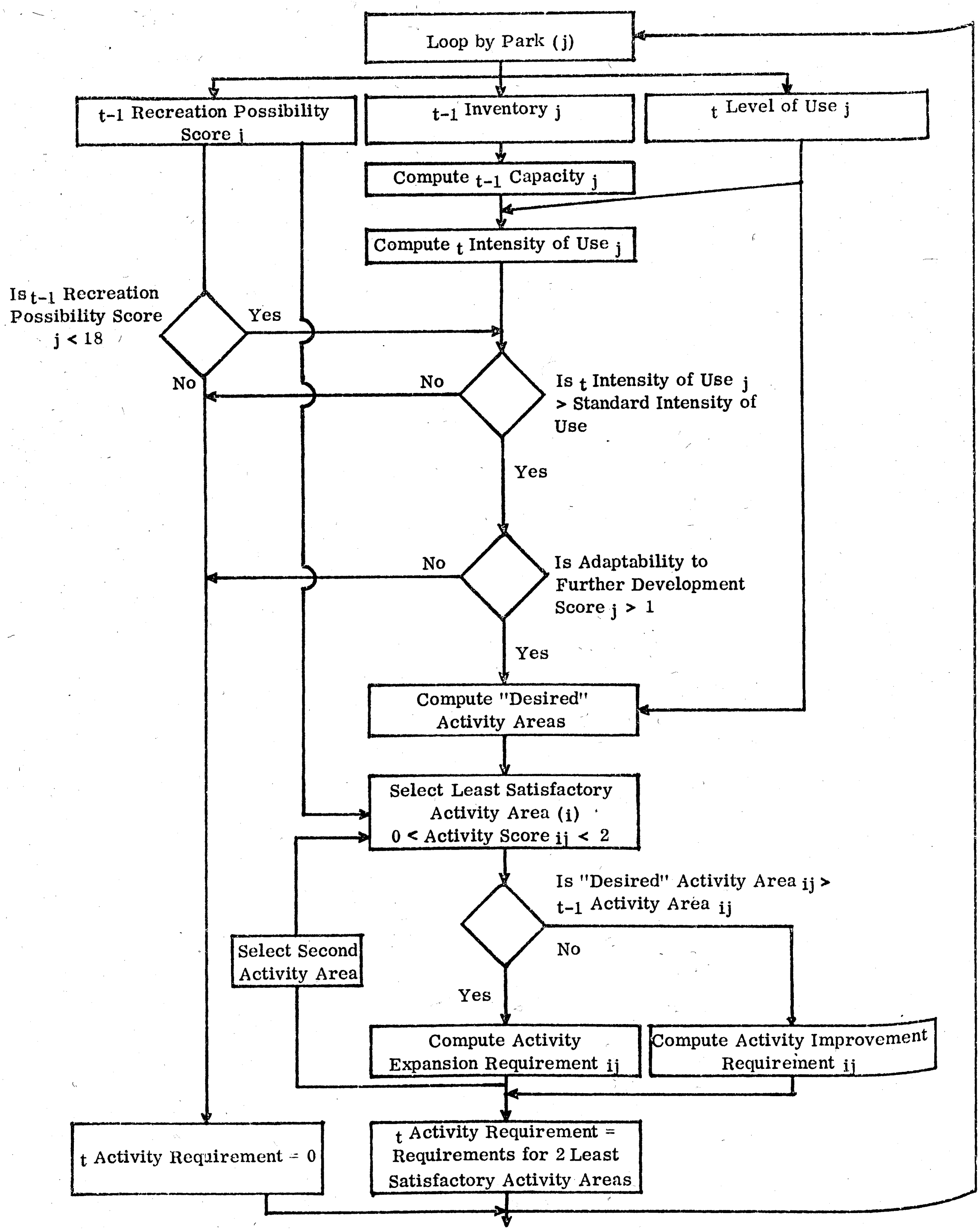

Figure 2. Flow Chart of Activity Requirement Determination Procedure

Model Solution Sequence. Referring back to Figure 1, the flow diagram of the two-park model, the first step in the solution sequence is the determination of use levels for Parks 1 and 2 for year t. These determinations are based upon information about the household levels of use and participation rates for each park. As indicated, a households' park use level is influenced by the socio-economic characteristics of the household, the distance to and the quality of the park, and the distance to and quality of the nearest alternative park. Logically, a households' use of a particular park (e.g., Park 1) will be greater the closer they live to the park, the higher the quality of Park 1, and the greater the distance to Park 2. However, the quality of Park 2 may dampen use of Park 1 if, over time, quality of Park 2 increases relative to Park 1. Increased quality of an alternative site overcomes some friction resulting from distance to the site.[3] To estimate the annual man-days use of Parks 1 and 2 generated within a specified distance zone, the household level of use value by zone is multiplied by the corresponding number of households in the zone using the park. The total level of use of the parks is then the sum of levels of use, by zone, for each park.[4]

As indicated in Figure 1, this information, for period t, plus information on budget levels and t-1 supply characteristics of Parks 1 and 2 enter the decision process.[5] Period t maintenance and capital improvement funds are allocated to Parks 1 and 2 according to the decision rules alluded to in the preceding discussion. As a result the t-1 supply characteristics are altered, i.e., they are updated to period t. For example, investment in activity areas would alter the recreation possibility score of a park, investment in facilities and expenditures for maintenance alters the facilities score, and land acquisition investment may lead to a change in the size score of a park. Hence, park quality would be altered. Activity investment will tend to reduce a park's adaptability to further development score while land acquisition will increase this score and reduce the possibility of expansion score.[6] Investment in facilities will also alter the inventory level of a park. Estimation of these effects of investment and expenditures completes one cycle of the model. Time is incremented one year and the t+1 levels of use for Parks 1 and 2 are determined. By definition, the t+1 users of parks and recreation areas are faced with t supply conditions or, specifically, t+l household level of use is estimated using t quality indices for Parks l and 2. The quality variable serves as the link between the investment decision process and the level of use parks in the system. In the next iteration, t investment decisions, as reflected in t+l Park l and 2 levels of use, will influence t+l investment decisions. The criterion for a feed-back loop is met. Other feed-back loops exist in that investment alters future maintenance requirements and, as noted above, may influence future investment possibilities.

THE MODEL AS A PLANNING TOOL

The basic model was used to analyze 58 parks and recreation areas in Iowa. The first step in the analysis involved the simultaneous adjustment of the model and generation of a baseline series of projections. The model was started using 1962 data. Time series of : 1)level of use, 2)capacity, 3) intensity of use, 4) quality, 5) facilities score, 6) adaptability to further development score, 7) possibility of expansion score, 8) maintenance expenditures, 9) facilities' investment, 10) activities' investment, 11) land acquisition investment, and 12) total capital improvements for each park were projected to 1980. The results were also summarized on a park system basis--this summary includes time series of systems: 1) level of use, 2) capacity, 3) capital improvement and maintenance appropriations, 4) facilities, land acquisitions, and activities investment, and 5) total capital improvement investment. Projected park and system values for 1963 to 1967 were compared to actual values. Scoring system parameters were adjusted until these values, to the degree possible, closely corresponded. The baseline series of projections were therefore a by-product of the adjustment process.

The baseline series is, in itself, useful for planning purposes. In addition, the model was used to project the effects of various parameter and model structure changes. These independent changes included: 1) increasing facility and activity area standards to reflect initiation of a park improvement program, 2) increasing availability of capital improvement funds to allow more intensive development of existing parks, and 3) extending the basic model to allow for the development of new parks within the system. In each case, the effects of the proposed changes were evaluated relative to the values of selected variables in the baseline series.

CONCLUSIONS

It is believed the analytical structure, summarized in this paper, provides a unique and realistic framework for explaining the relationship among economic units in the public outdoor recreation sector. The empirical results, reflecting a normative environment, should serve as guidelines for planning and decision making by the subject agency. The major result of the study, however, was the demonstration of a means for examining the relationship between the provision of a public service and the level of use of this service.

Undoubtedly, there is room for improvement in the model formulation procedures, particularly with respect to specifying decision rules. As is the case in most simulations, there is a great need for more and better data. Additional research, directed toward the refinement of procedures and techniques used in this study and toward developing improved data systems, will enhance the value of simulation as a tool in public outdoor recreation investment research.

FOOTNOTES

1. Dotted lines with directional indicators represent the flow of information from one component to other components. Solid lines trace the flow of information from the source to utilizing units. This flow is regulated by decisions of the Parks Section of the Commission. The decision process is represented by the symbol X. Circles in the flow charts are auxiliary variables, the value of each being exogenously determined.

2. Level of use and capacity are both stated in man-days use.

3. The forms of the household level of use equations for Parks 1 and 2 would be as follows:

$$ {}_tLU^z_{i1} = a + b_1\,({}_tY_i) - b_2(D_{jz}) + b_3(D'_2) + b_4({}_{t-1}QS_1) - b_5\,({}_{t-1}QS_2) \quad (1)$$

$$ {}_tLU^z_{i2} = a + b_1\,({}_tY_i) - b_2\,(D_{jz}) + b_3\,(D'_1) + b_4\,({}_{t-1}QS_2) - b_5\,({}_{t-1}QS_1) \quad (2)$$

where: ${}_tLU^z_{i1}$ = annual man-days use of Park 1 by household i in distance zone z, time period t,

${}_tLU^z_{i2}$ = annual man-days use of Park 2 by household i in distance zone z, time period t,

Y_i = all socio-economic variables,

D = the midpoint of the distance zone around each park,

z = the distance zone designations (1,2,3,4,5,6),

D'_2 = distance from Park 1 to alternative Park 2,

D'_1 = distance from Park 2 to alternative Park 1, $D_1 = D_2$ for the two-park case,

QS_1 = quality index for Park 1,

QS_2 = quality index for Park 2,

t = current year,

$t\text{-}1$ = previous year.

[4] Specifically, $_{t}LU^{z}_{.1} = PR^{z}_{1} \cdot {}_{t}LU^{z}_{i1}$, (3)

$$_{t}LU^{z}_{.2} = PR^{z}_{2} \cdot {}_{t}LU^{z}_{i2}, \qquad (4)$$

where:

PR^{z}_{1} = the number of households in zone z of Park 1 using Park 1,

PR^{z}_{2} = the number of households in zone z of Park 2 using Park 2,

z = 1, 2, 3, 4, 5, 6

and

$$_{t}LU_{.1} = {}_{t}LU^{1}_{.1} + {}_{tt}LU^{2}_{.1} + \ldots\ldots + {}_{t}LU^{6}_{.1}, \qquad (5)$$

$$_{t}LU_{.2} = {}_{t}LU^{1}_{.2} + {}_{t}LU^{2}_{.2} + \ldots\ldots + {}_{t}LU^{6}_{.2}, \qquad (6)$$

where:

$_{t}LU_{.1}$ = level of use, Park 1,

$_{t}LU_{.2}$ = level of use, Park 2,

5. Supply characteristics are the number and total investment to date in selected facilities (inventory), the size of activity areas within the Parks, and the quality, adaptability to further development, and possibility of expansion scores of the parks.

6. The major control element in the model is a deductive scoring system, designed to alter all scores to reflect conditions after investment or maintenance expenditures. Scores are also a function of changes in the level of park use.

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