SIMULATION OF IOWA'S PUBLIC OUTDOOR RECREATION SECTOR: A DECISION-ORIENTED RESOURCE MANAGEMENT MODEL*

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The Outdoor Recreation Resources Review Commission (ORRRC) 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 [6, p. 137]. It contended that if states were to discharge their responsibilities as major suppliers of outdoor recreation services, they "must clearly intensify their current activities" [6, p. 139]. However, legislative and appropriating bodies have not in the past encouraged public 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]. Thus, Clawson and Knetsch can assert "planning and research in outdoor recreation lag far behind current needs" [2, p. 289].

Consistent with these views, the primary objective of this paper is to report a model that

(1) incorporates and explains critical structural and policy linkages 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, is useful for state-level planning purposes.

The scope of this paper is limited primarily to a description of the basic model structure; a more complete discussion is found in [1]. To describe the basic model, the public outdoor recreation sector for the State of Iowa is defined and three key elements of the basic model--the park quality index, the relevant time interval and the simulated public agency decision process--are discussed. The last section of the paper includes some brief remarks on simulation strategies as related to planning.

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*Constructive comments of Dan Chappelle, Department of Resource Development, Michigan State University are gratefully acknowledged.

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Model of Iowa's Public Outdoor Recreation Sector

Iowa's public outdoor recreation sector, as defined in this study, includes the following economic units: recreationists, the Parks Section of the Iowa Conservation Commission, and the Iowa General Assembly. The Conservation Commission is 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 Section 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].

Park Quality Index

The park quality index is based on a "standard of desirability" rating project of the Parks Section [3]. Three members of the Parks Section staff independently rated each state park in Iowa with respect to physical and aesthetic quality, recreation possibilities, size, adequacy of facilities, adaptability to further development, and possibility of expansion. The classification standards are listed in Table 1.

Park scores for each of these items is the average of the scores assigned by the three evaluators. The recreation possibilities score is the sum of a park's recreation activities (swimming, boating, fishing, and others) scores. Park quality (QSj) is defined as the sum of the park's physical and aesthetic quality, recreation possibility, size, and facilities scores. The park quality index, the adaptability to further development score and the possibility of expansion score serve as the key control elements in the model to be discussed.[1]

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 the Parks Section in a particular site influences the use level of that site and, in turn, future investment decisions.

To identify the information-feedback effect in the discussion of the two-park model, consider a time interval of one year starting with the opening day of the park season and ending the day before the next park season. Implicit in defining the time interval is the assumption that site used in a given year t occurs on facilities available at the end of year t-1. This

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[1]Spatial interrelationships among state parks are taken into account in the household level-of-use functions rather than the park quality index.

TABLE 1: Iowa Park Classification Standards [3]

	Score
1. Physical and aesthetic qualities:	
a. Archeological	
Has high value; of statewide significance	3
Has medium value; of regional significance	2
Has low value; of local significance	1
Has no significance	0
b. Botanical	
Has high value with unusual or wide variety of species	3
Has medium value with at least one unusual species or a good variety of species	2
Has low value - somewhat above ordinary	1
Has no significance	0
c. Geological	
Has high value with outstanding cliffs, bluffs, ravines, caves, rock outcroppings or other geologic features	3
Has one or more of above features of medium quality or interest	2
Has one or more of above features of low quality or interest	1
Has no significance	0
d. Historical	
Has high value; of statewide significance	3
Has medium value; of regional significance	2
Has low value; of local significance	1
Has no significance	0
e. Scenic	
Outstanding	7-8
Good	5-6
Fair	3-4
Poor	1-2

2. Recreation possibilities:

a. Picnicking		
b. Camping		
c. Hiking		
d. Sightseeing	(Offers good to high satisfaction)	2
e. Nature study	(Offers medium to low satisfaction)	1
f. Fishing	(Necessary features and/or	
g. Boating	facilities not available)	0

		Score
2.	Recreation possibilities: (Continued)	
	h. Swimming	
	i. Winter sports	
	j. Trail riding	
3.	Size:	
	a. 0 - 25 acres	1
	b. 25 - 50 acres	2
	c. 50 - 100 acres	3
	d. 100 - 200 acres	4
	e. 200 - 300 acres	5
	f. 300 - 400 acres	6
	g. 400 - 500 acres	7
	h. 500 - 750 acres	8
	i. 750 - 1000 acres	9
	j. over 1000 acres	10
4.	Facilities:	
	a. Inadequate	1
	b. Just about adequate	2
	c. Adequate - will stand increased use	3
5.	Adaptability to further development - area is such that topography and/or size permits needed facilities without crowding or destroying natural features for which the area was established:	
	a. None	0
	b. Poor	1
	c. Fair	2
	d. Good	3
6.	Possibility of expansion - lands surrounding area are of a type that could be added for public use in relation to the area itself:	
	a. None	0
	b. Poor	1
	c. Fair	2
	d. Good	3

assumption is consistent with the Parks Section practice of scheduling major construction or maintenance projects for the off season.

Decision Process

The Parks Section decision process is the pivotal element in the model; it receives information from the recreationist component, it utilizes information on park supply characteristics from within the Parks Section component, and it serves 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 are considered, namely, activity areas, facilities, and land. The decision process involves two steps--determination of item expenditure requirements, and specification of actual levels of investment and expenditures by park.

Figure 1 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, 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.[2] If one of the three criteria is not met, the park is not accepted for investment consideration; hence, the activity requirement for that park is set at zero.

If the park is accepted for investment consideration, "desired" activity area sizes are computed using Parks Section standards and information about park level of use. 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, conditions within the activity area are assumed to be such that the activity score is low. Hence, a capital requirement for improving the area is computed.

Procedures for determining capital improvement requirements for land acquisition and for adding facilities are quite similar but much less complex than those for estimating activity area requirements. The general procedure for deriving land acquisition is outlined in Figure 2. Information inputs

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

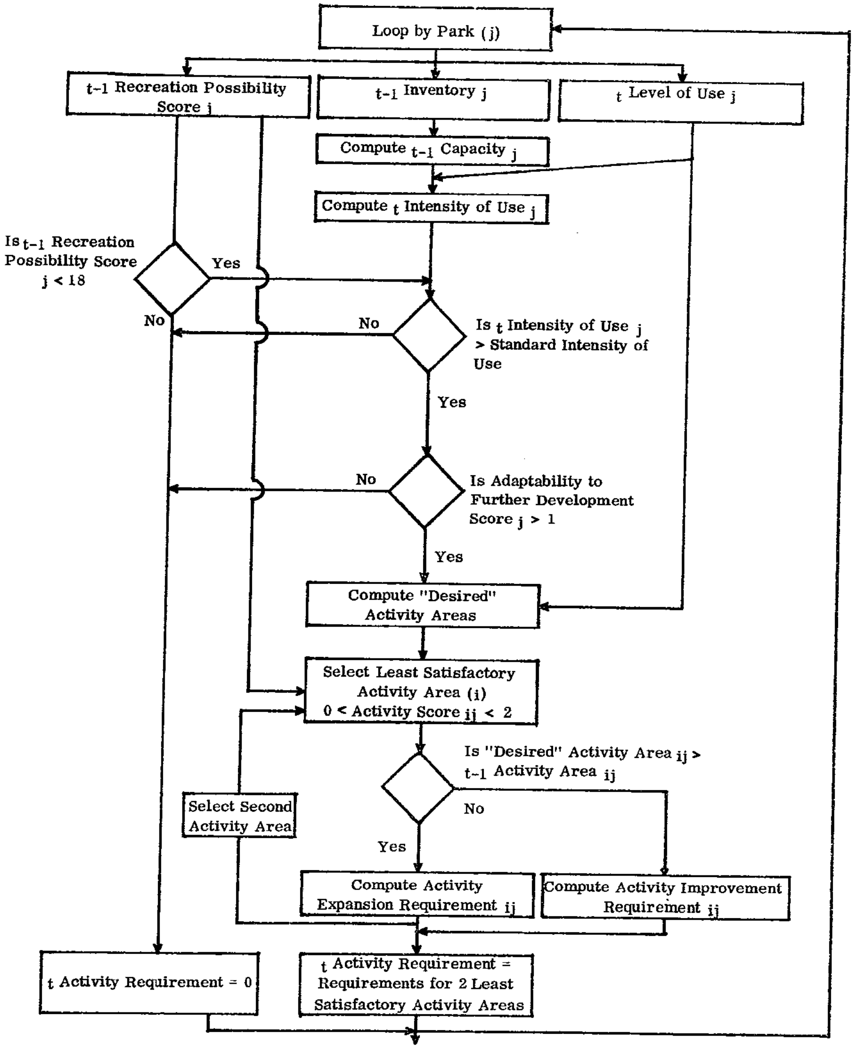

FIGURE 1. Flow Chart of Activity Requirement Determination Procedure

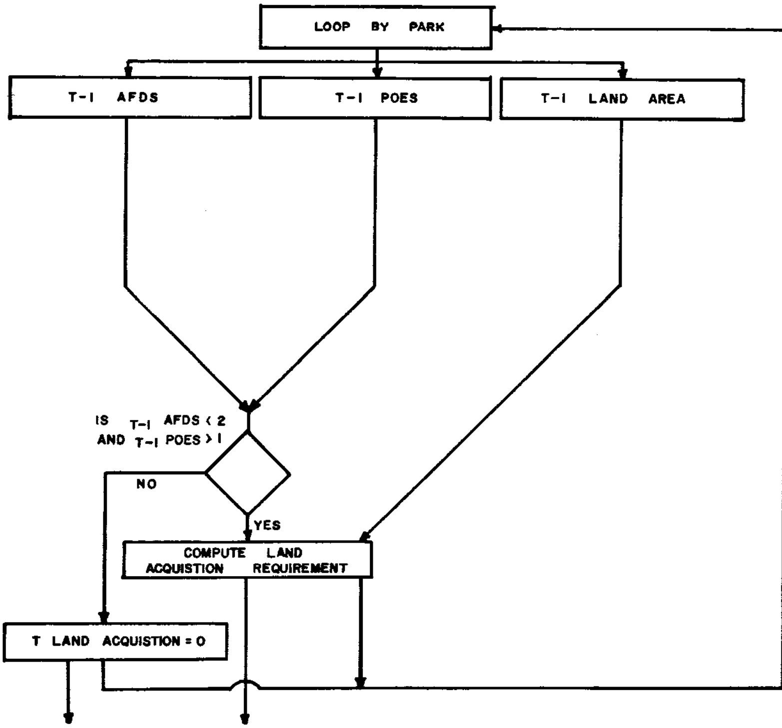

FIGURE 2. Land Acquisition Determination Procedure

include the current land area and the adaptability to further development and possibility of expansion scores.

The criterion for proceeding to the land acquisition requirement determination is that adaptability to further development be at least fair to poor and that the possibility of expansion exists. This criterion forces the internal development of the park before land acquisition is allowed.

Note that parks having a very low possibility of expansion score will not be enlarged. The adaptability to further development score constraint is reduced as internal development of the park progresses over time.

Determination of park facility requirements is outlined in Figure 3. Information inputs include pre-season park facilities inventory and seasonal park level of use. "Desired" facilities are computed using Parks Section specified standards and information about level of use. If desired facility levels exceed actual levels, a facilities requirement is specified.

In addition to capital improvement considerations, maintenance and repair requirements are computed for each park. Repair and replacement requirements are computed as a function of the pre-season inventory level. Labor requirements are a function of park size and level of use.

The second step in the decision process involves balancing 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 (Figure 4). 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.

Over time secondary parks will receive proportionately more of the available funds as investment opportunities decline in the more popular parks. Both balancing processes reflect the system of priorities specified by the Parks Section.

Model Solution Sequence

Essential elements and logical sequence of the public outdoor recreation sector model for a two-park case are presented in Figure 5. The model was constructed with three basic components corresponding to the three specified economic units.

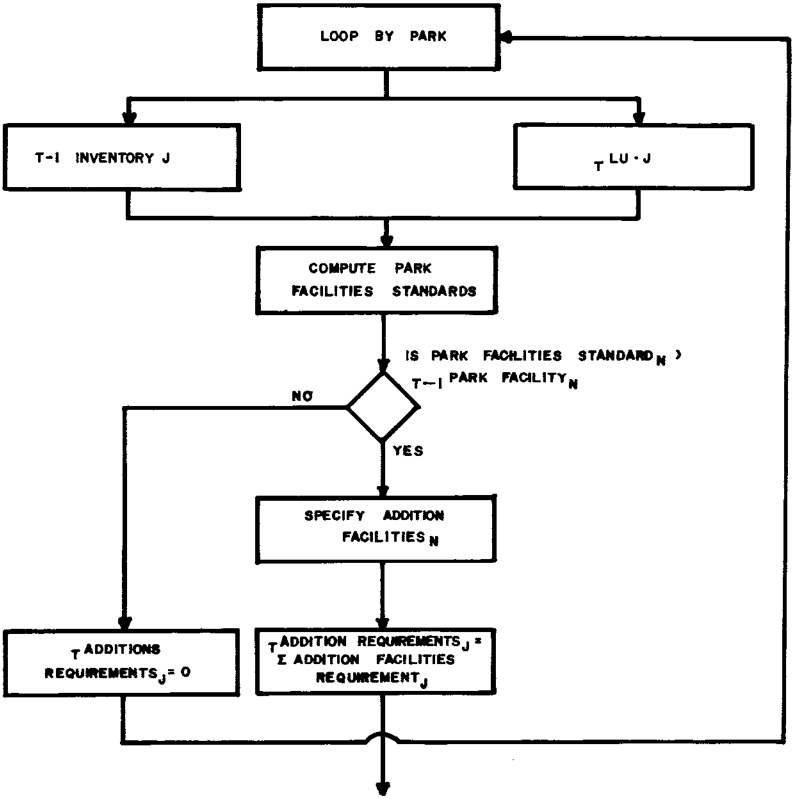

FIGURE 3. Facility Addition Requirement Determination Procedure

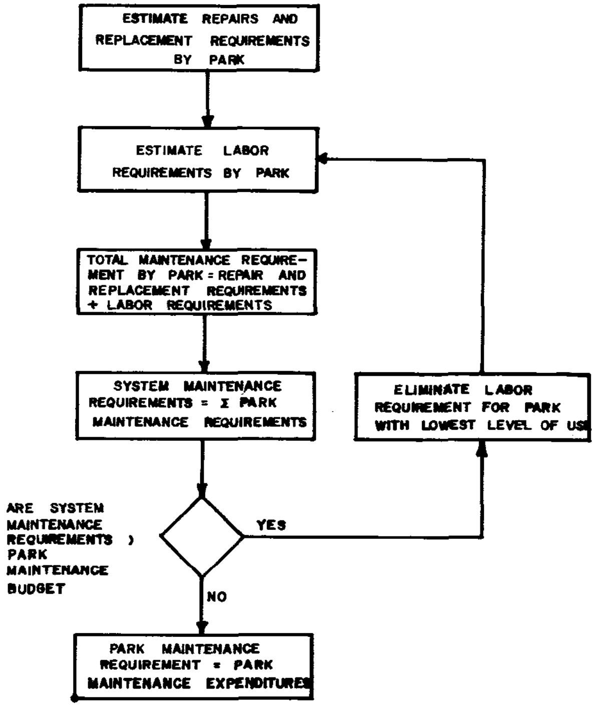

FIGURE 4. Flow Chart of Maintenance Budget Allocation Procedure

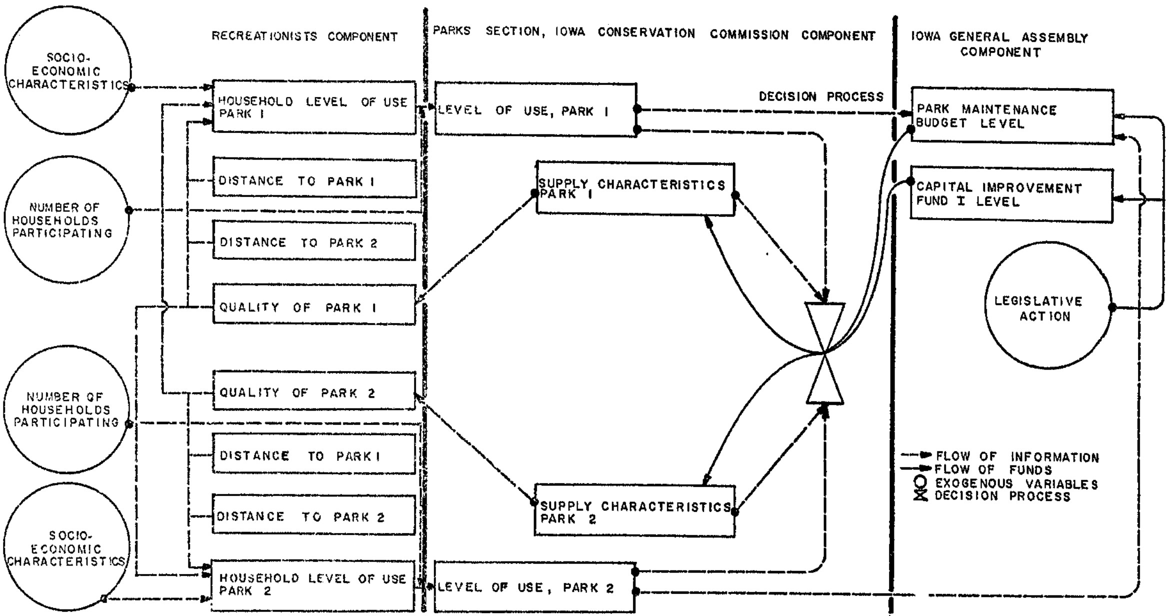

FIGURE 5. Flow Diagram of the Two-Park Model

The first step in the solution sequence is the determination of use levels for Parks 1 and 2, which are based on (1) socio-economic characteristics of the household, (2) distance to and the quality of the park, and (3) distance to and quality of the nearest alternative park. A household's use of Park 1, for example, increases with proximity to Park 1, and with higher quality of Park 1, but decreases with proximity 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.

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.

As indicated in Figure 5, level-of-use information for period t, plus information on budget levels and t-1 supply characteristics of Parks 1 and 2, enter the decision process.[3] 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 updated to period t.

For example, investment in activity areas alters 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 is altered. Activity investment tends to reduce a park's adaptability to further development score while land acquisition increases this score and reduces the possibility-of-expansion score.[4] Investment in facilities also alters the inventory level of a park.

Estimation of the 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+1 household level of use is estimated using t quality indices for Parks 1 and 2. The quality variable thus serves as the link between the investment decision process and the level of use of parks in the system.

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[3]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.

[4]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 intensity of park use.

In the next iteration, t investment decisions, as reflected in t+1 Park 1 and 2 levels of use, influence t+1 investment decisions. The criterion for a feedback loop is met. Other feedback loops exist in that investment alters future maintenance requirements and influences future investment possibilities.

Summary and Conclusion

The major emphasis of the paper is methodological with a focus on the definition of a public investment decision process. The basic park investment model is viewed as a step toward identifying relevant decision variables. The model thus demonstrates one means of examining the relationship between the provision of a service by a public agency and the subsequent level of public use of these services.

At the risk of oversimplifying, the major limitations of the park investment model are traced to data constraints--a common problem in most simulation studies. However, a by-product of this research effort was a recommendation to the sponsoring agency concerning the types of data that should be accumulated to facilitate research of the type described. Thus, the potential development of a goal-oriented data systems enhanced the value of the simulation runs as a tool in public investment research and planning.

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