A method for selecting public investments in outdoor recreation facilities which will increase social benefits

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A method for selecting public investments in outdoor recreation facilities which will increase social benefits

by

Charles Dudley Mattson

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CHAPTER I. INTRODUCTION

Public planning for the systematic development of outdoor recreation service has undergone phenomenal growth in recent years. That this has been most evident at the state level can be traced directly to the grant-in-aid program initiated by the federal government under provisions of the Land and Water Conservation Fund Act of 1965 (37). Comprehensive planning is a precondition for qualifying for grant assistance under this act. Plans of the states must be approved by the Secretary of the Interior who has delegated the supervision of state planning to the Bureau of Outdoor Recreation (BOR). This bureau has developed general guidelines to assist state agencies to complete plans which will meet BOR standards (31).

History of State Planning

State planning for the expansion of recreation service on a comprehensive scale is a rather new art. Planning effort for recreation service was long exemplified by elaborate site plans for individual projects with little effort to plan for systems of parks or other recreation areas. Doell cites Laurie Cox, writing in 1931, on site selection and design of parks, "that as far as he (Cox) could see, there was no state that had a real master plan for a state park system" (8, 11, p. 50).

One of the earliest attempts at planning for comprehensive recreation development of state resources was the 25-year conservation plan for Iowa developed by Jacob Crane (9). Of particular interest was the recognition by Crane that several kinds of recreation areas should be provided, offering different levels of service for differing intensities of
use. Crane was among the early planners to suggest that state park distribution should provide about equidistant access for all people of the state. He suggested a pattern of major state parks to handle mass recreation needs at a spacing of 80 miles. This was to be supplemented by "state preserves" offering less development and fewer activities, but without regard to spacing. Mr. Crane did not make allowance for the unequal distribution of population which would require greater capacity for serving cities within their assumed radius of travel. This report further reveals a concern for park choice based on unique qualities of statewide significance (both for parks and for preserves). Emphasis was given to the passive activities of viewing scenery, natural and human history, with accommodation of active recreation pursuits as required (9).

In a staff report to the Director, California Department of Parks and Recreation, Aldrich gives a brief review of the history of state park planning in California (1). This review covered the study of twelve key planning documents beginning with a contract study by Frederick Law Olmsted, Jr., in 1928. This earliest report is certainly the most comprehensive in urging the development of a variety of services, including roadside rest stops, highway camps, historic sites, large scenic parks and recreation areas. In an analysis of this first Olmsted report, Aldrich says:

The report is a good example of the resource approach to planning a new park system. It does not attempt to classify and quantify the amount of recreation needed within desirable ranges of urban centers. This "user-approach" type of park planning however, is a relatively new concept almost within the past fifteen years. As population densities increase and competitive demands for recreational lands increase, pressures rise for the user-approach. Actually the park agency should use both. (1, p. 16).
A number of subsequent planning studies are described in the Aldrich report, all of them since World War II. The last study reported was in 1964. He has this to say in his summary concerning selection of areas for development as state parks:

The selection of areas to be included in the System has been based primarily on the high quality judgement and "professional know-how" of a relatively few staff individuals, the Director, Chief, and on the dedication of Commission members.

The major emphasis in the selection of areas has been on the preservation of outstanding natural, scenic and historical values and the provision of associated non-urban types of recreation. In later years pressures have grown to acquire more areas for community and regional day-use recreation and for preservation of questionable natural and historical values. Generally, the State has acquired these areas only when they could not withstand the pressures. Such areas are known in the Departments of Parks and Recreation, Finance, Legislative Analyst office, and even some local governments as "cat and dog projects" - they do not measure up to standard as units of the State Park System.

Selection of areas has not been based upon a formal presentation of a statewide analysis of needs for preservation and recreation. (1, p. 2).

After noting that California had no long range or master plan, Mr. Aldrich completed his assignment with an outline recommending elements of long-range planning.

a. Analysis of present and future State Park needs of two types:
   (1) Needs for types and amounts of recreation within desirable distances from urban centers.
   (2) Needs for preservation of examples of California's natural scenic and historical values.

b. Inventory of areas, facilities and services to meet the above needs.

c. Determination of State park deficiencies.

d. Definition of the role of the State Park System in relation to roles of other agencies of government.
e. A program of State Park priorities to meet deficiencies for five, twenty and fifty years. (1, p. 3).

In this recommendation he follows Doell's suggestion that master plans include . . . "acquiring some areas of uniqueness irrespective of geographic location but supplementing those areas with state parks in proximity to centers of population and virtually 'hand molding' them into the desired shapes and equipping them with suitable facilities for state park service." (11, p. 50). I have quoted extensively from the California report because it seems to epitomize the intensified search by state governments to achieve continuity, consistency and defensibility in their development programs. The ability of state agencies to plan comprehensively to provide for the two distinct kinds of service listed by Aldrich has come only lately and with much painful confusion. Choices for investments to provide development of unique resource areas are likely to be determined in individual cases as a result of subjective judgement of public officials and in response to political pressures. Providing for the needs for active recreation is much more amenable to systematic planning based on studies of resources, population, preferences, time, income, and mobility combined with the economic factors of producing recreation service. Criteria for choice of these areas can be spelled out with greater precision.

Planning Efforts in Washington

In Washington, the State Planning Council and its Advisory Committee worked with a National Park Service team on a Study of Parks, Parkways and Recreation Areas in 1939. Recommendations in this report
included one for the development of long-range recreational plans and policies and outlined administrative machinery to implement them (Planning and Community Affairs Agency (46). The present Parks and Recreation Commission was established in 1947, though no truly comprehensive planning resulted until much later. The Planning Council also recommended a further study to establish priorities for recreational development. With the dissolution of the Planning Council in 1945 and transfer of its functions to the Department of Conservation and Development, comprehensive planning was shelved for nearly 20 years (44).

The State Parks and Recreation Commission developed a 20-year master plan for state parks which was adopted in 1956. This plan projected park needs to 1975. Following the adoption of this plan rapid strides were made in rounding out park areas and adding new areas to the system (44). During this period, further gains were made in allocating revenue sources in support of the park and parkways fund.

Following a statewide citizens conference on open space and recreation in 1962 the governor appointed an Interagency Committee on Outdoor Recreation, composed of representatives of state departments concerned with outdoor resources. This committee began work on comprehensive planning about 2 years prior to the federal grant-in-aid program from the Land and Water Conservation Fund (LWCF).

The Impact of Federal Programs to Aid States

In 1965 the federal government initiated a grant-in-aid program (LWCF) to provide a stimulus to the states to plan for, acquire, and develop recreation resources (37). In implementing this program the
Bureau of Outdoor Recreation (BOR) provided guidelines to state planners (31). To appreciate the effect of this federal program on state planning activities, it is helpful to quote from the Executive Summary of this manual.

6. **Designation of Responsible Agencies.** To be eligible for financial assistance under the Act, a State must designate in writing the agency or official which has authority to represent and act for the State as the State's liaison officer in dealing with the Director for purposes of this program.

7. **Statewide Plan Required.** To qualify for assistance for acquisition or development, a state must prepare a comprehensive statewide outdoor recreation plan which the Bureau finds to be adequate for the purposes of the Act. Such a finding will be for a period of from one to five years. To continue eligibility for acquisition and development assistance, the plan must be maintained and updated on a continuing basis.

8. **Basis for Assistance.** Financial assistance is provided on a project-by-project basis. Before any apportioned funds may be granted, the State must submit and secure approval of specific project proposals. The Bureau may approve only those project proposals submitted by the designated State agency . . .

9. **Priorities of Assistance.** Project priorities will be established by States subject to concurrence by the Bureau. Basic policy guidelines for determining priorities are provided in Part 640. The State Plan will establish a general framework of priorities. Within this framework, more specific priorities will be established in the course of submission and approval of project proposals (31, Parts 600.3.6.—600.3.9).

Most of the early grants to states were made to help them initiate or refine their planning efforts. Very few states had developed truly comprehensive plans spanning the activities of all concerned state agencies. None had seriously attacked urban problems—listed by BOR among the high priority needs. The passage in 1965 of the Housing and Urban Affairs Act, expanded the Open Space Grant program to assist urban governments in acquiring open space for recreation and other purposes in
cities (38). This program has encouraged state planners to include the needs of urban areas. There followed a period of trial planning by state agencies together with continued refinement and interpretation by BOR of its planning guidelines. Early plan approvals by BOR were typically of short duration, specifying further refinement to maintain eligibility for acquisition or development grants.

Two problems have proven troublesome in developing and implementing acceptable plans.

(1) The development of a planning methodology and decision-making framework to provide for a coordinated, comprehensive program.

(2) The development of criteria for choosing those projects which should be funded from specific budgets.

Projects must be defended to the BOR to receive matching assistance. They must also be defensible to state legislators who are asked to approve all capital budgeting for the state's share of these projects.

The development of a single comprehensive plan has been one of the most difficult problems faced by the states. At the time of the nationwide survey by the Outdoor Recreation Resources Review Commission (ORRRC) only about a third of the states were organized with a central agency responsible for all or most of the land management and development activities on state lands (20). A considerable degree of autonomy in planning and capital budgeting existed in the individual agencies of the remaining two-thirds of the states. Experience in comprehensive planning was almost non-existent in those states where responsibility was divided among several commission style agencies, each serving a different citizen
clientele. Even in those 17 states where a single department existed, some agencies with responsibility for recreation service were not included, e.g. highway departments and water agencies.

The Present Situation

One of the first jobs tackled by the states (in 1965) was the creation of a coordinating body to attempt the job of harmonizing the planning activities of the several managing agencies. A single agency (or representative) is required by the grant-in-aid program administered by BOR (31, 600.3.6). In Washington, the governor has appointed an Interagency Committee for Outdoor Recreation (IAC) charged with this coordinating job.\footnote{A survey of all states and territories (55) conducted by the author in 1968 revealed the following types of agencies responsible for comprehensive planning: planning office or interagency committees=19; resource managing agencies (embracing parks, forests, game et al.)=16; park departments =12; game department=1; highway department=1; unknown=6.}

In Washington, state plans completed to 1968 have been produced by the Department of Commerce and Economic Development as a part of the state comprehensive planning program with the cooperation of the IAC (42). This planning effort was begun with assistance from the Section 701 program of the Housing Act of 1954 (amended), administered by the Federal Housing and Home Finance Agency (41). The IAC retains responsibility for approving individual projects submitted by state and local agencies and administers funds from the Outdoor Recreation Account. In addition, the chairman of IAC is officially designated the State Liaison Officer to the BOR in administering the Land and Water Conservation Fund program (22).
Subsequent revisions of state plans are the responsibility of the newly created Planning and Public Affairs Agency (23). In November 1968 the people of Washington approved Referendum 18 to authorize the sale of 40 million dollars of general revenue bonds for the acquisition and development of outdoor recreation areas and facilities of the state. By policy and by law, one-half of these funds will be available for state and one-half for local government use. With the passage of this bond referendum we can expect to see a considerable increase in the extent and intensity of planning efforts at both levels of government.
CHAPTER II. THE PROBLEM

The Problem Situation

The preceding account of some of the planning efforts of states to meet public expectations for outdoor recreation opportunities describes the background of the problem situation. This situation contains the following elements:

1. The demand for outdoor recreation land and facilities appears to be rising faster than opportunities are being developed—the gap is widening (32).

2. The states are expected to take a leadership role in providing large increases in opportunities for active kinds of recreation (19).

3. In response to public pressures and stimulated by new federal grant-in-aid programs, the states have developed comprehensive plans which identify most critical needs.

4. Many states have recently created capital funding programs intended to begin closing the gap.

5. The states are just beginning to face up to the task of designing systems for allocating development funds in the most effective manner.

6. Uncertainty exists as to just which criteria are appropriate to use in guiding investments for the most effective use of public funds.
7. Most states have adopted sets of criteria which provide qualitative guidance in choosing high priority investment opportunities.

8. No state has yet devised an evaluation system which provides for comparison of alternate choices for development in a quantitative manner.

Out of the above observations it is possible to construct some of the dissatisfactions which exist among agency officials concerned with public recreation service. There is an implied dissatisfaction with the methods which have been used in the past to plan investments in recreation resources. This is evident in the report of Aldrich for California (1). This dissatisfaction has intensified recently as a result of greatly increased public attention and the consequent rise in available capital funds.

Uncertainty has also developed about how best to implement the new federal programs for fund sharing in recreation development. The BOR has insisted on a comprehensive approach to planning. This has called for new approaches in many states where responsibilities were divided among several autonomous agencies—-at least two-thirds of the states in 1962 (20).

Beyond the stage of comprehensive planning, decisions must be made in allocating funds among competing state agencies and local subdivisions. Because the scope of these new plans and programs is greater than in the past, many states are inexperienced and unprepared to cope with these new problems.
In implementing the grant-in-aid provisions of the Land and Water Conservation Act, the BOR has required the states to select a single agency or official to represent the state in dealing with the Director (31). This has had the effect of assigning responsibility for allocating state funds for capital developments to this same office in most states. In many states, new offices have been created, often with representation from the several managing agencies involved. In others, the existence of a comprehensive style agency, embracing all or most land management activities has provided the location for this new responsibility.

The Objectives of This Study

The situation described above has within it a number of problems for which solutions are not apparent. The objective chosen for this study is the development and testing of a system for selecting projects for implementing comprehensive plans.

Study Procedure

The procedure followed in this study consists of four steps:

1. A review of comprehensive planning and project selection methods with special attention to Washington (state).

2. Development of a proposed system for evaluating and selecting projects.

3. Test application of the proposed system using project plans from Washington agencies.

4. Development of methods for increasing the precision of the system through improvement of data quality.
In step 1, we will review project evaluation methods widely used for many public investments. The latest Washington comprehensive plan will be examined in some detail with special attention to the latest methods employed in implementing this plan (Chapter III).

In step 2 we will develop the proposed system for evaluating and comparing proposed projects. A general model will be developed for evaluating quality and efficiency (Chapter IV). While these two criteria have been chosen as the basis for this model, this study will focus primary attention on the efficiency criterion. The inclusion of a quality criterion emphasizes explicitly that efforts to improve the effectiveness of public investments cannot be based on economic considerations alone. The treatment of the quality element is meant to be suggestive rather than definitive. Much work remains to be done to refine quantitative measures of quality.

The efficiency model will be developed in detail and presented in operational form (Chapter V). The data required by the model will be detailed, together with a discussion of the quality and availability of data secured in Washington (Chapter VI).

Tests of the proposed system will be made using 22 plans secured from two Washington agencies (Chapter VII). Testing of the system was designed to reveal the problems encountered in application and the potential contributions to the decision making process. In no sense was it intended to be a comparison of the proposed system with other possible systems for selecting public investments in recreation service.
Testing is of a quite informal but nevertheless useful kind. It consists in essence of trying the system out on the 22 selected plans. The manner in which the alternative plans are ranked in terms of quality and efficiency by calculations prescribed by the system are then considered. Questions pondered include: What difficulties are encountered in applying the proposed system? How large are differences in quality rankings and efficiency ranking? Do there appear to be intuitively sensible bases for the differences in rankings?

This last question illustrates both what these tests are, and what they are not. An ideal and wholly objective test would compare results given by several proposed systems. It would do this in terms of the degree to which each system measured up to pre-determined criteria of an "ideal system."

The tests that are carried out in this study fall short in two interrelated ways. Only one system for rating public investments in outdoor recreation facilities is examined. And there is no "ideal system" against which the results of this one system can be compared.

Nevertheless, the limited tests that it had been feasible to carry out in this study are useful. The simple process of trying out the system has done several things. It has shown it to be workable in the sense that the necessary data can be secured, and the prescribed calculations made, without undue difficulty. Certain modest difficulties have been identified. For example, planners are not required to provide alternate plans for comparison; techniques are not yet available for consistent prediction of use rates from clientele areas for new plans. They could be focal points of future efforts to improve the system. The process of trying
out the system has also shown that it produces quality and efficiency rankings that are intuitively sensible. This judgment is based on the author's knowledge of the specific sites and knowledge of those sites on the part of personnel of the two Washington departments. These intuitively reasonable results give reasonable assurance that the proposed system can be used to evaluate sites and development plans for which less direct knowledge is initially available.

The precision of the model is directly dependent on the quality of data provided. The effect on output values of alternate values for instrument variables will be systematically examined using sample plans (Chapter VIII). Computer programs will be developed for:

1. Evaluating the sensitivity of all model variables.
2. Comparing the relative sensitivity of all critical variables by means of a standardized test.

Examples of these sensitivity tests will be presented and their uses discussed.

In the chapters which follow, several Washington agencies will be mentioned frequently. In order to shorten the discussion, they will usually be referred to by their initials. The most frequently mentioned are:

2. Washington Interagency Committee for Outdoor Recreation (IAC).
4. Washington Department of Natural Resources (DNR).
5. Washington Department of Parks and Recreation (DPR).
CHAPTER III. SYSTEMS FOR EVALUATING PROJECTS

This chapter provides a brief review of project appraisal methods in use for public investments. Recreation project selection methods used by most states are surveyed and summarized. The most recent Washington state plan is then reviewed in some detail together with a description of project selection methods presently used to implement this plan.

Benefit Cost Analysis

Methods for evaluating public projects involving large capital outlays and long-term benefits have undergone rapid refinement in the last twenty-odd years. The widely used technique of benefit-cost analysis has been particularly powerful in appraising the relative feasibility of multipurpose reservoir projects. Ratings are customarily expressed as a ratio of benefits to costs (B/C). Discounting procedures are used to obtain a common time base, usually present values.

Benefit-cost feasibility studies have been widely accepted as the preferred method providing benefits can be expressed in dollar terms. Difficulty has been encountered where benefits have no easily identified market values. Where benefits and costs involve wildlife or recreation outputs, the lack of acceptable market values has seriously impaired the usefulness of this technique. The current practice in evaluating recreation benefits from proposed projects is to assign an arbitrary value per visitor-day to the expected visitation over the life of the project (35).

Clawson and Knetsch urge the application of benefit-cost analysis to the selection of recreation investments. They recognize, however, that
quantification of benefits remains a problem and that "imputed values are needed" (7). Numerous studies have been reported which attempt to derive these imputed values for recreation service (4, 6, 52, 53).

As experience has been gained in economic analysis of the opportunities for investment in resource development, including benefit-cost analysis, emphasis has increased on evaluation of alternative means of securing desired ends to assure maximum social benefits (26, 35). Recent developments in federal budgeting procedures are directed toward this specific comparison of alternatives (36). These guidelines are being refined for ever wider applications to federal agency programs and require specified quantitative measures of efficiency in more and more government activities. Complex analyses comparing alternative combinations of inputs and resulting outputs are now possible by use of activity analysis methods, particularly linear programming.

A recent BOR study reports the pilot testing of three possible methods for examining program effectiveness of planned investments in outdoor recreation. The report concludes that benefit cost appraisal is the least acceptable method because of the difficulty of quantifying benefits. The preferred approach was a "composite method which combines project cost with the recreation supply deficit of an area to produce a weighted project effectiveness rating." (33, p. 12). This method provides comparisons of alternative choices of projects (or groups of projects) to identify gains in the effectiveness of investments.
Criteria Used by States

Progress to date in quantifying benefits from recreation investments for operational decision making is quite limited. A number of states have adopted systems for comparing project proposals under a variety of criteria. Most of the ratings are made by the collective judgement of responsible officials (2, 14, 43). One state, Indiana, has considered a system for comparing alternative proposals for state recreation areas using an approach developed by consultants (27). A benefit-cost appraisal is made using expected revenues to the state from fees, concessionaire leases, etc. as benefits, set over estimated costs of capital investments, operation and maintenance. Ratings are achieved in the form of internal rate-of-return calculations in which the rate is that which equates present investment with the present worth of expected future net returns. This approach is justified on the basis of Indiana policy which requires that state recreation service be self-supporting for operation and maintenance costs (27). Apparently this system has not been adopted for screening acquisition and/or development projects for the state program. So far as is known, no public agency is presently using benefit-cost analysis with carefully derived primary benefits as a basis for recreation investment decisions.

In the fall of 1968, the author surveyed the state liaison officers used by the 55 states and territories. Returns were received from over 90 per cent of these officers. Of those reporting, only 13 indicated that

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1/ State liaison officers have been appointed to represent their governments in all dealing with the BOR in arranging grants from the Land and Water Conservation Fund.
a formal rating was made of each proposal to determine priority for funding. Seven of these had developed systems for use in screening local proposals, one was used only for state proposals and five states rated both state and local projects.

The rating systems examined include from 6 to 13 stated criteria, each having assigned point weights for potential scoring. Most of the criteria covered the same considerations as are listed by BOR in its Outdoor Recreation Grants-in-Aid Manual (31). Most of the 36 states which do not use a point rating system, list similar criteria in evaluating projects by the subjective judgement of screening officials.

The criteria listed by reporting states may be grouped into six categories as follows:

1. Demand related.
2. Efficiency.
3. Political or geographic balance.
4. Level of significance (local, regional, or state).
5. Preservation of unique resources (primarily for acquisition proposals).
6. Degree and quality of local effort (used only for screening local proposals).

All of the 13 "rating" states list several criteria which are demand related. When combined, these constitute the group with heaviest weighting. Preservation of unique resources, particularly those threatened by loss, receive the next strongest emphasis. The remaining four categories are included in half or less of the reported lists of criteria.
Of the six groups of criteria, there are three which are amenable to quantification by objective measures: (1) demand related, (2) efficiency in terms of cost per unit of service, and (3) political or geographic balance. The other three categories include criteria which appear to require evaluation by subjective judgement.

One fact stands out clearly from this study: the process of allocating funds to recreation development can be and is approached in a wide variety of ways. All states employ a number of criteria in the choice decisions, some of them very general and many quite subjective. There is a wide variety in the weights given similar criteria. In a majority of states no explicit weighting system is used.

A number of states reported plans or developments in progress for refining their selection process. They mentioned the mounting pressure from local governments for shares in the funding program. This appeared to have the effect of forcing a more formalized evaluation system for screening proposals.

The Washington Plan

The latest planning effort in Washington represents a long step forward in planning sophistication. Four key elements are recognized as the essential framework: (1) the demand for recreation opportunities, (2) the existing supply of recreation land and facilities, (3) land and development standards for converting demand to quantified measures of

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1/ This section is taken principally from the Washington Statewide Comprehensive Outdoor Recreation and Open Space Plan. First Official Revision effective date July 1, 1969 (47).
need, and (4) an action program for meeting identified needs. It is recognized that present demands and supplies represent the logical starting point in identifying existing needs. Further extension of planning requires estimates of future needs based on growth of elements (1) and (2).

Additional elements of the plan are included to conform to state and federal legal requirements for funding and planning programs.

Figure 1 shows the relationship of the various elements of the planning process. In order to identify the potential contribution of our study to the action phase of this process, it is necessary to understand the techniques used and the kinds of outputs generated by the planning phase for inputs to the implementation program.

**Supply and demand--area types**

A fundamental departure from previous methods of cataloging needs has been used in this plan. The use of activity days to estimate demand has proved unworkable in identifying land and facilities needed. The new plan uses the concept of area-type as a means of expressing needs and supplies in common terms.

An area-type is (defined as) an environment which is based on the need for space for outdoor recreation activities (user-oriented), the need to protect the natural setting from conflicting uses (conservation-oriented) or a combination of the two (user-conservation oriented) (47, p. 68).

Each of these three groups is made up of six to eight area types, representing the variety of areas and developments typically found in each. (See Appendix for complete list.)
Fig. 1 Outdoor recreation planning process in Washington (47, p. 64)
The existing supply of recreational resources was derived from an inventory of lands of all area-types in each of thirteen planning regions of the state. In addition, an inventory was made of all potential lands of each area-type for each region.

A demand study was completed in early 1968, using a statewide sample of households which:

1. Measured rates of use of the 21 area-types.
3. Determined where and when activities took place.
4. Determined characteristics of households.
5. Measured the degree of unfulfilled recreation desires.

The results of this demand study were expressed as average peak-day participation rates for each region by area type.

The distribution model

The model used inputs from the supply and demand studies plus four other kinds of data. These were: (1) land cost and appreciation factors, (2) average development costs in each region for each area-type for new lands acquired, (3) standards, which determined land requirements for users and cost of development of facilities for each area-type in the regions, (4) population estimates for projected target years.

With data for the above four classes of information reduced to punched cards, the distribution model was programmed to yield estimates of need. Estimates were provided in acres by area types and in dollars for each region for the base year 1967. Using population projections, land appreciation factors and projected participation rates, need estimates were

The evaluation model

An evaluation model has been developed as a preliminary guide in allocating funds by regions for acquiring needed land by area-types. This is described as a "linear model (used) to analyze all possible combinations of factors. The model indicates by area-type and region where acquisition will yield the most favorable benefit-cost ratio." (47, p. 9). In order to understand the capabilities and limitations of this model, we quote extensively from a publication by the consultants to the IAC which defines the methods used to develop the draft plan quoted above. In this paper, the authors quote the following section from the Planning Grant Application to the BOR, which partly financed this planning study.

The decision-making responsibility of the I.A.C. should be strengthened through the use of analytical facts developed by new management science techniques. One of these techniques - Linear Programing - is a mathematical method for, among other things, directing the most efficient use or acquisition of resources toward a cardinal objective such as maximum cost-benefit. It should be remembered that utilization of such a technique would not in any way supplant the function of the committee. Rather, the process should be regarded as the provision of a management tool to the committee by rapidly providing them with accurate data based upon available funds, projected criteria and alternative approaches under the policy guidance of the committee.

The program, then, will utilize data (in punched card format) developed during the plan phase, will present basic considerations affecting the expenditure of funds and will provide, based upon the restraint of the I.A.C., various programs of land acquisition and development that will best utilize available funds. The first problem to be solved is the development of a mathematical formula (Model) for computer application that will be compatible with the data already gathered under the 'plan sequence' of this study.
Model

Briefly, the model must be capable of maximizing demand satisfaction subject to set of restrictions (constraints). The three principal objectives of this model will be:

1. To insure an adequate stock land and facilities to meet a reasonable level of demand satisfaction.
2. To make maximum use of funds in acquisition and development.
3. To provide as an aid to decision making, rapid retrieval of data upon open space lands.

Constraints

Certain factors exert an influence upon the acquisition and/or development of land. These restrictions will be applied during the mathematical analysis sequence. Some of these constraints are briefly mentioned below:

1. Available Funds:
   During the course of the project, a study will be required of all sources of financing available for meeting the objectives of the program by source.

2. Land Appreciation:
   Another input to the decision making process could be a set of land appreciation factors by class of land and by region. This also will assist the committee in deciding the best balance of land acquisition to make the maximum use of available funds.

3. Sufficiency Criteria:
   Another input to the formula will be the determination of a measure of efficiency of existing open space within each region. Factors such as this can point out problem areas where the supply is far out-stripped by the need and where special consideration should be given to meet such influences as burgeoning population or land speculation.

By combining this and other data into the computerized mathematical model, it will be possible to provide alternate courses of action for the I.A.C. to enable them to make their best judgment as to the most efficient program of acquisition and development of open space land by location, type and cost with a high level of cost effectiveness.
Additional Data Required:

1. **Financing**  (This paragraph states the need for estimates of future financing available from all levels of government.)

2. **Values to Recreational Land**

---the use of evaluation models requires firm input on such facts as land values, availability of sites and other concrete factors. Value judgments, however, are difficult to determine upon a quantitative basis. Values have, however, been placed upon certain types of recreation areas in the present I.A.C. program. These "values" are the project criteria and rating systems under which financing has taken place in the past. The BOR Grants-In-Aid Manual lists certain criteria for acquisition and development while the I.A.C. also makes, in its rating system, "value" judgments as to the urgency of certain types of projects over others.

For full utilization of the evaluation techniques suggested in this interim report a "value factor" for each area type as it relates to each region of the State will be required. (I.A.C. Planning Grant Application to the BOR, original not available.)

While the I.A.C. has adopted the BOR criteria, it is recommended that the I.A.C. with the aid of its staff and technical committee develop and adopt a revised set of criteria as a basis for "value factors". This can be used as an input into the computer program to give alternative courses of action (25, pp. 64-66).

It is apparent from the last paragraph that the "model builders" (authors) are less than satisfied with the "value factors" given them by the IAC. It is certainly a worthwhile goal to provide decision-makers (IAC) with more powerful tools for making choices. However, the critical weakness remains that of assigning values to the land and developments which are to provide recreation service. The conclusion seems inescapable, as the BOR researchers concluded (33), that a benefit-cost approach is not feasible for guiding these allocation decisions.

The evaluation model developed for the state plan is intended for the use of the IAC at a level above that of individual project appraisal. Using only inputs from planning surveys, it will not provide the deliberate
comparison of one site proposal with another which would provide similar service in the same planning region. It does provide a means, based on the "value factors" determined by the IAC, for favoring one type of development over another. The problem remains of comparing individual site proposals which would provide like service.

Project Selection in Washington

The plan implementation process is keyed to decision-making in the IAC. As administrators of the Outdoor Recreation Account they have established procedures for handling project applications for funding. The following section of their Procedural Guidelines states their rating policy for evaluating proposals from local agencies:

One of the following alphabetical priorities will be assigned each project proposal if it is to become a BOR proposal:

Priority A - Includes all projects for which action is needed immediately.

Priority B - Includes those projects on which action must be taken in the near future or an opportunity to preserve a valuable resource will be lost or the needs of a broad segment of the public will not be met.

Priority C - Includes those projects on which action must be taken in the future to meet needs that exist now.

Priority D - Includes those projects for which, although immediate action is desirable, financing can be deferred for a period. Such projects would generally be designed to meet foreseeable future needs that do not fully exist at the time of submission of the proposal.

In addition to being in compliance with the state-wide plan and meeting Initiative 215 requirements, local project proposals require objective rating on a point system as part of the screening process and assignment of priorities. Such an evaluation method has been devised to assure fairness and uniformity in the ranking of proposals. The BOR criteria adopted by the IAC as a statement of policy in September 1965 provide the framework upon which this rating system has been developed. The topical headings below are derived from elements set out in the BOR criteria.
The ideal project will score 100 points. Points should be distributed as follows:

A. BENEFIT CRITERIA. ........................................... 25
   1. General Population served 15
   2. Segment of Public (specific) 10

B. SITE CHARACTERISTICS. ................................. 30
   3. Environmental Qualities 10
   4. Demand/supply 20

C. USE RELATIONSHIPS .................................... 35
   5. Diversity of Functions 10
   6. Extent of Participation 15
   7. Per Capita Development Costs 10

D. BONUS FACTORS ......................................... 10
   8. Planning 5
   9. Cooperation 5

TOTAL 100

A. BENEFIT CRITERIA. ........................................... 25

1. Population Service (General - 15 points)

Priority is given to meeting the needs of the greatest number of people. To determine the extent to which a project will meet these needs, it is necessary to delineate the service area. The service area is determined by applicable recreation area standards, information furnished by applicants, our field inspection and the type and location of each project.

Access to the project from the service area will be evaluated by considering location of the project within the area in relationship to access facilities.

2. Segment of Public (Specific - 10 points)

Proposals to benefit the general public will receive priority over those intended for a segment of the public. In the evaluation, special consideration will be given to the needs of the handicapped, aged, and under-privileged.

If the facility is designed to serve a broad spectrum of age groups, including the aged, higher rating will be given.

The degree of physical capabilities (vigor or fitness) necessary for participation will be evaluated to weight more heavily those
activities which will serve the broadest public spectrum and allow the handicapped to participate.

Activities requiring relatively little expenditure per person thus allowing the economically underprivileged to benefit will generally receive the highest rating.

Evaluation will be given and points given to provide consideration to those facilities requiring less skill.

B. SITE CHARACTERISTICS .......................... 30

3. Environmental Qualities (10 points)

Projects which would enhance, preserve or restore areas of natural beauty or areas with open space, archeologic, geologic, historic, biotic, etc., values will receive higher consideration. A rating will be assigned dependent upon how well the project is designed to accomplish such goals. Additional points will be assigned dependent upon the urgency to take action on projects to preserve site quality.

4. Demand/supply Ratio (20 points)

High priority will be given to acquisition projects dependent upon the scarcity of outdoor recreation acreage within the area. The demand/supply/need relationship for recreation land will be analyzed using current NRA area standards. The number of points awarded will be dependent upon the percent that an area is deficient in the type of facility. The percentage of supply added to an existing recreation inventory will receive credit.

C. USE RELATIONSHIPS .......................... 35

5. Diversity of Functions (10 points)

Priority will be given to projects that will ultimately provide for a broad range of activities, thus providing a wide spectrum of usage. Priority will also be given to projects being brought into full public utilization most rapidly as indicated by a six-year capital improvement program.

6. Extent of participation (15 points)

This rating will be developed with analysis and evaluation of standards applied to various types of facilities to measure capacity.

7. Per Capita Development Costs (10 points)

Projects which result in a low per capita cost over an extended
period of time will receive higher priority. Immediate evaluations will be based on an estimated annual attendance figure, furnished by the applicant, divided into the total six-year development cost, also furnished by the applicant. A rating scale inverse to per capita cost applies in this evaluation system.

D. BONUS FACTORS

8. Planning. Projects within jurisdictions benefiting from comprehensive planning will receive extra points.

9. Agency Cooperation. Extra points will be assigned to the projects which indicate cooperation with other jurisdictions or citizen groups (43, IV-434.1 and 436.2-436.4).

The selection process cited above was developed to guide the IAC in appraising projects submitted by local agencies (cities, counties, port authorities, recreation districts). The screening of state agency proposals (for use of the state 50% of the recreation fund) is accomplished in a different manner. Share percentages of the state one-half have been allocated by policy decision among three state departments: Parks and Recreation, 53%; Game, 36%; Natural Resources, 11%. Since each of these departments has experience and personnel in recreation development, they are each expected to identify high priority projects which serve to implement their particular goals. Projects are conceived and planned by the respective agencies, from which high priority projects are chosen for submittal to IAC for capital funding. The IAC conducts an independent appraisal of each proposal through its technical staff. Alternate plans are not submitted for comparison. Each approved project must be consistent with priorities established in the comprehensive state plan.

This system appears to have at least one serious drawback. While in the broadest sense, all proposals submitted by an agency are competing for funds from the current budget, there is no assurance that the best or
most efficient proposal to provide a particular kind of service has been identified. Unless the IAC insists that several proposals be developed to provide similar service in a given region there is no opportunity to evaluate and compare in an effort to invest funds most effectively.\footnote{At a meeting of the IAC (Tacoma, Washington, April 8, 1969) the chairman, Lewis Bell, stated that he was dissatisfied with the present method of allocating funds for acquisition and development to agency projects. He further stated that the committee should work toward a real consideration of numerous possible projects using agreed upon criteria for the selection of high priority projects for early funding. He would prefer to work toward abandoning the present formula distribution among agencies as a more systematic appraisal system were perfected, thus permitting greater exercise of choice by the IAC.}

Obviously for the agencies to provide the IAC with comparative choices requires that more time and effort be spent in appraising alternate sites, and, perhaps, multiple plans for each.

**The Problem of Choice**

Part VIII of the new plan states that "... the basic goal of the Action Program is to assist in meeting statewide needs through the distribution of resources to encourage acquisition and development of priority open space and outdoor recreation areas and facilities at all levels of government and in both the public and private sectors." (47, p. 304). In achieving this general goal, these seven objectives are listed.

1. To allocate funds from the Outdoor Recreation Account for projects proposed by state and local public agencies based on the degree to which such projects satisfy needs identified in this plan.

2. To optimize the allocation of resources at all levels of government, thereby avoiding duplication of services.

3. To encourage realistic outdoor recreation capital improvement programming throughout the state.
(4) To encourage consideration of allocation of resources for open space and outdoor recreation opportunities on a plane of equal importance with public health, education, welfare, law enforcement, and public works.

(5) To encourage maximum benefit from existing resources through creative and innovative public land use policy.

(6) To encourage innovative methods of providing new outdoor recreation areas and facilities in the best interests of available funds, the private landowner, and the public user.

(7) To encourage the private sector in providing outdoor recreation opportunities such that public and private involvement complement one another. (47, pp. 304, 305).

The purpose of this section will be to develop the concepts of a model to provide an operational tool to assist in achieving objectives (1), (2), (3), and (6) for state agency investments. From an examination of present practices in Washington, we have seen that decisions for funding state agency projects are now based on a combination of political compromise (the formula allocation among agencies) and subjective appraisal by members of the IAC. Need has been expressed for two improvements in the choice process: (a) quantified measures to replace subjective judgment where possible and (b) several alternative choices for providing comparable service to that incremental gains may be measured.

From examination of appraisal systems in a number of states it is clear that no single criterion can be used to select high priority projects. We are faced with a mixed criterion problem. The IAC must employ (1) a need criterion through meeting the demands of all users for a variety of settings and activities (area types), (2) a location criterion (by regions and service areas), (3) a quality criterion (choosing the best available above some specified minimum), and (4) an efficiency criterion for providing the maximum possible service within given budgets.
These criteria will be recognized as sub-criteria of a peak criterion which provides the objective function to be maximized. The goal is to select that set of investments which will maximize the social benefits from a given state budget.

Kelso has pointed out, in reference to water resource development decision-making, that the "complex aggregate of non-homogeneous subsets puts it (the peak criterion) conceptually within the principle of the product-product relation of production economics theory." (15, pp. 7, 8). Conceptually we are interested in the trade-off values between subsets of the peak criterion, analogous to the marginal rates of substitution among products. Unfortunately, we are unable to measure either costs or benefits of possible projects under the several sub-criteria on a common scale. The best we can hope for is some system of comparing projects offering similar service wherein we can examine possible trade-offs between criteria on agreed upon scales of value.

As we attempt to visualize a statewide system for selecting investments using the criteria listed above, we see immediately that the problem must be approached at a lower level of aggregation. We have already suggested that competing proposals can only be compared in a valid way if they are planned to provide similar service. The adoption of area-types in appraising supply and demand and estimating need in the new state plan provides the first simplifying step.

The need criterion has been given careful attention in the state plan. The evaluation model (described in the previous chapter) has been developed to summarize need by area types for use in the action program (50). The development of a choice model for a given region and area-type must
accept the level of need defined in the action program (or some specified fraction) as the upper bound for total investment in that region and area-type. While regional allocations of budgets for acquisition and development are planned, the choice of which area-types to favor at each planning interval is expected to revert to the IAC by 1971. For the next biennium, the formula allocations to the three states agencies will provide initial allocation among groups of area types typically managed by the respective agencies. Further partitioning of capital budgets is guided by needs specified by the plan, refined by the agency's own priorities.

The location criterion has been partially applied by the adoption of 13 planning regions in Washington. Location is related to specific kinds of service through the use of the sphere of influence concept. Sphere of influence radii are specified in the standards adopted for most of the area-types used in the plan (conservation oriented area-types were omitted). The sphere of influence is defined as "the distance people normally will travel to participate in activities on a particular area-type" (47, p. 70).

Quality has been included in the list of criteria for selecting local projects (quoted earlier from the Procedural Guidelines) (43). The new state plan has revised this list of criteria, and specifically considers quality only in cases where high quality resources are in need of preservation (47).

In discussions with members of the IAC technical staff concerning procedures for evaluating state agency proposals, they emphasized that field examinations of environmental quality and adaptability to development play a large part in crystallizing the judgment of committee
examiners regarding project desirability.\(^1\) As mentioned earlier, consider-able reliance is placed on the personnel of the submitting agencies who are familiar with sites available for development or considered for purchase, to screen for sites of highest environmental quality before selecting those for development proposals. There seems to be a general feeling that this criterion cannot be objectively handled in rating proposals.

Probably evaluation of quality will remain largely subjective in nature. However, it should be possible to provide guidelines for examiners which would list the various facets of quality for inclusion in a system for scoring competing proposals in a comprehensive way. Such an approach will be proposed in a later section.

The revised list of criteria in the new plan includes four listed as economic:

1. Provision of basic rather than elaborate facilities.
2. Capability of the participant to finance, operate and maintain the project. (This obviously applies to local government applications.)
3. Relationship of benefits to costs.
4. Individual user costs (47, p. 317).

Number (1) is a restatement of policy, not an operational criterion. Number (2) is not applicable at the state level since state investments can be assumed to carry with them a commitment to operate and maintain

\(^1\) Interview with Phillip Clark, IAC staff, in Olympia, Washington, April 9, 1969.
new facilities under existing agency programs. In an operational sense we have observed that benefit cost analysis, (3) founders on our inability to quantify benefits in terms comparable to costs.

User costs are here recognized for the first time as a criterion for appraising proposals. In the model presented below, a portion of user costs will be incorporated in the efficiency term.

In the present practice followed by the IAC the only gauge of the efficiency of a given project is for total development and for land costs, together with capacity defined as "persons at one time (PAOT)." (25, p. 43). Since only single plans are presented for a particular region or service class, no comparisons can be made.
CHAPTER IV. A PROPOSED SYSTEM FOR SELECTING PROJECTS

In this chapter the proposed selection system is outlined in general terms. The rationale employed for each element, quality and efficiency, will be developed. The quality element will be presented in its operational form.

Assumptions Required for the System

A number of assumptions must be stated before developing the system proposed for this study. The situation in Washington with regard to each assumption will be noted.

1. A comprehensive plan has been adopted which specifies the need for either (a) capacities for various kinds of outdoor recreation activity, or (b) various kinds and amounts of facilities and land. In Washington, the first revision of the comprehensive plan has been adopted which specifies needs for 21 area-types in each of 13 regions.

2. A single agency of the state has been assigned responsibility for allocating capital funds for outdoor recreation, from both state and federal sources. In Washington the Interagency Committee for Outdoor Recreation (IAC) is charged with this responsibility.

3. The state operating agencies (e.g. Parks, Game, Highways, Forests, et al.) submit proposals for land acquisition and/or development to the central approving agency. In Washington proposals for state acquisition and/or development projects are submitted by the three state departments: Game, Natural Resources, and Parks and Recreation, to the IAC.
4. The several criteria to be incorporated in the system and their respective importance--weights--are specified by the approving agency of the state. The IAC has set a criteria for judging local proposals (50% of available funds). The state share is divided among the three state agencies on a formula basis. Projects are either approved or disapproved.

5. There is a fixed capital budget specified for each planning interval for which the system is to be used. In Washington a recently authorized state bond issue together with reasonably assured federal shares has made capital budgeting predictable for the next six years, 1969-1975.

6. Allocations of the fixed budget are made by the planning agency among regions of the state and among classes of service. In adopting the plan the Washington Legislature has approved these allocations.

7. The system will be used for screening proposals for acquiring or developing facilities for active forms of outdoor recreation. It is not intended for use in evaluating proposals for preserving unique resources, such as outstanding geologic, scenic or historic areas. The system developed in this study for guiding investment decisions is explicitly restricted to choices involving non-unique kinds of resources. Efficiency comparisons would have doubtful validity in appraising proposals for "one-of-a-kind" developments.

8. Expected revenues to be derived from a given proposal are not considered to influence the choice of one project over another.
Revenues are assumed to accrue to the state treasury and are not directly allocated to operating or capital budgets. In Washington the IAC has not considered the potential revenue from proposed developments as a valid criterion for favoring particular kinds of projects.

The Model in General Terms

The operational choice model proposed here consists of the following elements: (1) a quality criterion and (2) an efficiency criterion. Needs as given by the plan will constitute an upper limit on allocations to particular area-types or service classes. Initial applications of the model will be in specific planning regions. Location relative to users will be incorporated directly into the efficiency element of the model.

The model will be designed to produce a numerical score for each proposal which may be used as developed or, alternatively, may be added to scores developed from evaluations using other criteria which are deemed important by the selecting agency. In either case a composite score is provided for ranking competing proposals.

The model may be expressed as follows:

Ranking Score \( S \) = Quality score \( Q^* \) + Efficiency score \( E^* \)

(4.1)

in which:

\[
Q^* = Q \sum q_i
\]

(4.2)

where:

- \( Q \) = assigned weight, \( 0 < Q < 1 \)
- \( q_i \) = scores on individual facets, \( 1 \leq i \leq n \) of quality such that the sum of \( q_i \) are ideally = 100

Thus \( Q^* \) will take on values from zero to 100Q.
and $E^* = E\left(\frac{-D^*}{D}\right)(100)$

where:

- $E^*$ = the efficiency score
- $E$ = assigned weight, $0 < E < 1$
- $D^*$ = minimum cost per visitor day\(^{-1}\) achieved within the service class (area-type)
- $D$ = cost per visitor-day\(^{-1}\) estimated for proposed project

and $E + Q = 1$

It is essential that the sum of the assigned weights be equal to some constant. It will prove convenient if the sum of weights for all rating criteria used be set equal to one.

Facets of the Quality Criterion

When we think of quality as applied to recreation, we recognize that it is quality of the experience which we seek to provide—for ourselves as consumers, or for our visitors if we are administrators. That there are many aspects of the setting and the situation which contribute to (or detract from) a quality experience is axiomatic. As planners for the development of sites (settings), we are forced to assume that certain management practices will be used to assure that the situational aspects of quality will be controlled. Such aspects as freedom from crowding, safety, cleanliness, order, condition of improvements, water purity and others are clearly the responsibility of the on-going management of any developed site. For our purposes of evaluating potential developments, we must

\[1/\] Methods for calculating $D^*$ and $D$ will be developed in a subsequent section.
assume these aspects of quality are built into the system of the responsible managing agency and are beyond our purview.

Those facets of quality which must be evaluated for proposed developments fall into two categories: (1) the quality attributes of the site itself and (2) the quality of the improvements being proposed.

Pertaining to the site itself are such facets as (a) scenic beauty, (b) climatic relief, (c) vegetation (both its prospective durability and its scenic appeal), (d) freedom from hazardous terrain, (e) insulation from adverse land uses (e.g. highway traffic or commercial/industrial activity), (f) recreational water quality, (g) presence of nearby attractions (e.g. historic, geologic, etc.), (h) suitability for intended developments, such as terrain, soils, space. There are undoubtedly other site characteristics which require evaluation for particular classes of intended service. The extent to which they can be identified and examined separately permits a greater degree of objectivity in making comparative evaluations.1/

The second category, quality of proposed improvements, must also be partitioned into individual features of the planned development. The stated policy of favoring basic as opposed to elaborate facilities provides the framework for designers and evaluators in planning and rating the quality of proposed improvements. The focus on proposed developments is on the quality of service rendered. Under the efficiency criterion we will further examine the durability and associated maintenance costs.

1/ The U.S. Forest Service developed a system for rating potential recreation sites with similar criteria for use in the National Forest Outdoor Recreation Resource Review (28).
Facets of developmental quality to be included are: (a) access and interior roads for safety and maximum consideration of natural beauty effects, (b) design and choice of materials for harmony with the setting and functional convenience, (c) arrangement of activity areas for suitable separation and privacy together with ease of use, (d) quality of water and sanitation for safe, clean, convenient service, (e) quality of signing and information services planned, and numerous others. (In the test applications reported later, complete lists will be developed.)

Scoring Projects on Quality

The process of evaluating a project will normally be accomplished at two levels: (1) by the design team for the agency developing the proposal for within-agency review and (2) the inspecting team for the IAC responsible for making comparative evaluations. In the interest of comparable standards the steps in the rating process and the weights assigned to each facet of quality should be provided on a standard form, with instructions for its completion. When completed the form will supply the $\sum q_i$ required for the quality element in the model.

The allocation of relative weight to be given each of the $q_i$ is the job of IAC. The simplest system would assign each $q_i$ a weight $\frac{\sum q_i}{n}$, or equal weight. However, since this would likely result in fractional numbers a few facets would be assigned values just above or below the average, rounding all weights to whole numbers. A sample form is shown in Figure 2. The assigned weights have no special significance. The final choice of weighting is understood to result from the judgment of the evaluating agency (the IAC in Washington). The list of quality features is
Project Quality Rating

Project No. Name Area Type
Region No. Agency
Inspecting Team Inspect Date

(1) QUALITY OF THE SITE

<table>
<thead>
<tr>
<th>Possible Score</th>
<th>Scored</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Scenic Beauty</td>
<td>6.0</td>
</tr>
<tr>
<td>(b) Climatic Relief</td>
<td>6.0</td>
</tr>
<tr>
<td>(c) Insulation from Adverse Uses</td>
<td>6.0</td>
</tr>
<tr>
<td>(d) Safety of Terrain, Animal Hazards</td>
<td>6.0</td>
</tr>
<tr>
<td>(e) Recreational Water Quality</td>
<td>6.0</td>
</tr>
<tr>
<td>(f) Vegetation Durability</td>
<td>6.0</td>
</tr>
<tr>
<td>(g) Vegetation Suitability &amp; Amount</td>
<td>6.0</td>
</tr>
<tr>
<td>(h) Suitability of Terrain, Soil, Drainage</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Total Site Quality 48.0

(2) QUALITY OF DESIGN

<table>
<thead>
<tr>
<th>Possible Score</th>
<th>Scored</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Roads, access--beauty to users</td>
<td>3.0</td>
</tr>
<tr>
<td>--safety</td>
<td>4.0</td>
</tr>
<tr>
<td>(b) Roads, interior &amp; parking--convenience</td>
<td>3.0</td>
</tr>
<tr>
<td>--safety</td>
<td>2.0</td>
</tr>
<tr>
<td>--beauty</td>
<td>2.0</td>
</tr>
<tr>
<td>(c) Activity areas--convenience</td>
<td>3.0</td>
</tr>
<tr>
<td>--separation &amp; buffers</td>
<td>3.0</td>
</tr>
<tr>
<td>(d) Water developments--adequacy for heav. use</td>
<td>3.0</td>
</tr>
<tr>
<td>--control of purity</td>
<td>3.0</td>
</tr>
<tr>
<td>(e) Sanitation--adequate for heaviest use</td>
<td>3.0</td>
</tr>
<tr>
<td>--pleasing design</td>
<td>3.0</td>
</tr>
<tr>
<td>(f) Signing--meets information needs</td>
<td>3.0</td>
</tr>
<tr>
<td>--attractive, well placed</td>
<td>3.0</td>
</tr>
<tr>
<td>(g) Family units--adequate level space</td>
<td>2.0</td>
</tr>
<tr>
<td>--surface condition</td>
<td>2.0</td>
</tr>
<tr>
<td>--adequate screening</td>
<td>3.0</td>
</tr>
<tr>
<td>(h) Buildings &amp; structures--harmony of design and materials</td>
<td>3.0</td>
</tr>
<tr>
<td>--Placement for maximum service</td>
<td>2.0</td>
</tr>
<tr>
<td>--Parking and buffer space</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Total Design Score 52.0
Total Quality Score 100.00

Fig. 2 Rating form for evaluating site plans with suggested allocation of potential scores.
meant to be illustrative, not necessarily exhausting all facets of quality which might be deemed important in a particular evaluation system.

The Efficiency Criterion

The basic approach in developing this criterion is to provide a measure of cost per unit output. Decision is required on the appropriate output unit. The unit adopted in the Washington State Plan is acres for each area type for which standards have been defined, relating acres to the capacity to serve defined activity needs (49). Another output unit, the facility unit, is easily adapted to planning and budgeting, e.g., a picnic ground, a family campground, et al. Still another unit which could be used is "one time use capacity (OTU)" (33, p. 10). This is identical to the "persons at one time (PAOT)" defined by the planning contractors to the IAC in their description of standards (25, p. 43).

These are useful units for purposes of estimating the size of total "plant" (developed facilities) needed to serve predicted peak use periods. They have little utility when attacking the problems of choosing which sites to develop or how much capacity each site should have. Demand estimates are usually presented in units of visitor days of service for particular kinds of developments or areas. Planners must then convert these needs to units of capacity required to meet peak use conditions. Since we are here concerned with measuring and comparing the efficiency in relative cost terms between competing proposals, it is essential that these comparisons be made in units of ultimate service, visitor days. Researchers for the BOR point out the critical difference between capacity units and visitor days.
The visitor day measure is related to OTU but presents an important difference in that it reflects the specific use-pressure on each project. It is conceivable that projects with the same OTU totals will have significantly different visitation. The resultant output/cost of these projects will vary markedly between OTU and visitor day outputs. (33, p. 11).

In the efficiency element of the model developed below, we have chosen cost per visitor-day for the appropriate measure of efficiency. This requires that acceptable estimates of rates of use be made for all proposed projects. The BOR researchers did not suggest what might account for widely disparate use rates among projects having similar one time use capacities. Several obvious variables which could account for these differences can be listed, e.g. relative distance from clientele, site attractiveness, number of similar competing attractions and spectrum of activities available. Each of these variables must be considered when undertaking the prediction of use rate for a proposed development.

This study will not attempt a solution of this prediction problem. However, it is believed that reasonable predictions can be made by experienced planners working with agency personnel and calling on extensive demand survey data now being accumulated.\(^1\) Our proposed system for evaluating quality could be used as one input to a study to understand and explain the relative attractiveness of existing settings. The distance factor can be appraised through origin-destination studies. Competing attractions can be inventoried using a sphere of influence approach. Study is needed to evaluate the effects of differences in

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\(^1\) Estimates of this kind are required for water resource development proposals which include recreation as one purpose. The BOR is called on to make these estimates for all such projects proposed by the Corps of Engineers.
spectrum of activities variable. Popularity of and unfulfilled desire for certain activities have been identified in the most recent Washington demand study (48). By use of these data together with careful study of attendance at certain sites, combined with observation of activity patterns and on-site interviews, it should be possible to provide valuable guidance in estimating probable use of proposed new developments.

The cost portion of the proposed efficiency element must also be defined. In the list of criteria presently used by the IAC for evaluating local government proposals, the only costs identified are land and capital investments costs (43). The new state plan proposes to add user costs, but fails to indicate how these may be estimated or which user costs should be included (47).

Nowhere is there any mention of operation and maintenance cost as a necessary part of total cost estimation. Since comparisons between sites and between alternate design plans for given sites are intended in the use of this model, these costs could be responsible for critical differences. Efficiency in relative cost terms can only be compared by considering all of these costs simultaneously.

In 1962, President Kennedy approved for application the agreement of four executive departments entitled "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources." This agreement

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1/ This researcher has plans to initiate such a study at a future date.

2/ An agreement of the Secretary of the Army, Secretary of Agriculture, the Secretary of Health, Education and Welfare, and the Secretary of the Interior, prepared under the direction of the President's Water Resources Council.
spells out the basic policies and procedures for handling benefit-cost analysis of proposed projects. Project economic costs are defined as follows:

1. Project economic costs: The value of all goods and service (land, labor, and materials) used in constructing, operating, and maintaining a project or program, interest during construction, and all other identifiable expenses, losses, liabilities, and induced adverse effects connected therewith, whether in goods or services, whether tangible or intangible and whether or not compensation is involved. Project economic costs are the sum of installation costs; operation, maintenance, and replacement costs; and induced costs as defined below (34, p. 11).

In computing costs for our model, all of these costs except induced costs will be included. Induced costs would not, in most cases, occur in the acquisition and development of recreation sites since these are defined as uncompensated costs associated with the impact of a change in land use (34).

A cost related to induced cost will be recognized in specific project situations where land values cannot be determined readily from market information. This may occur when state-owned land is chosen for developing a desired project. In this case, an opportunity cost value would be used in the absence of appraised value or purchase price. Opportunity cost of land is derived by assuming that its value for recreation use must at least equal that in the next highest use. On many situations, the highest alternate use would be for recreation home-site or commercial recreation development (13).

The cost element of the model will include an additional item not listed in the above quotation. Associated costs are also defined for inclusion in feasibility studies as "The value of goods and services over and above those included in project costs needed to make the immediate
product or services of the project available for use or sale." (34, p. 11).

Since we have defined our product as visitor days of service at the site, we should logically include the costs incurred by the visitor to avail himself of the service.

Costs which are relevant here are those variable costs associated with the particular trip or occasion which result in the visitor days of service. These costs are largely made up of the travel costs incurred in moving from home to the destination area plus any entrance fees or charges for special services incurred. For most occasions (trips), the purchase of special equipment will have been made without reference to single trips and would be considered a fixed cost rather than a variable cost.

For the purposes of comparing competing projects, we may assume that, for a given class of service, fees and charges will be comparable since projects would likely be alternative choices within the program of a given agency, which applies standardized charge rates at similar developments. For example, Washington State parks have a standard fee for overnight use, the Department of Natural Resources, providing a different class of service, makes no charge for use. Consequently, we feel safe in omitting admission or other special charges as a criterion of choice between competing proposals.

It should be pointed out, parenthetically, that the prediction of attendance at any proposed development, requires explicit assumptions about charge rates to be imposed, especially if they will differ from competing alternate destinations. Obviously predicted attendance rates will have a critical part to play in efficiency calculations for proposed developments.
Our choice of the visitor day as a unit of output follows the practice of a number of economists who have adopted this unit of consumption in demand studies of various forms of outdoor recreation. Many of these studies have been summarized by Clawson and Knetsch (7). Other studies include two by Wennergren of boating and deer hunting in Utah (52, 53) and by Brown and others of salmon-steelhead fishing in Oregon (4). Wennergren used recreation trips as a unit of consumption, Brown used fishing days.

Visitor Access as One of the Production Costs

It is obvious that we are here concerned with a consumer good (service). Were it like most consumer services, its location would be market oriented. Hospitals, theaters, insurance agencies and like services are developed only where a sufficient market exists to demand these services. In each case the suppliers (whether public or private) must assemble all the factors of production, including the cost of transporting them to the place where the service is marketed. If the supplier operates in the competitive world of private enterprise, he is generally interested in maximizing net revenue from sale of his services. Public suppliers may at times offer their services at less than a price which covers all costs because of public decisions to provide services for the public good, e.g. public health and education. In both cases, the "market" exerts considerable pressure on suppliers to locate for the maximum convenience and minimum "transfer cost"\(^1\) of the customers.

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\(^1\) I have borrowed this term from Brown et al. who define transfer costs as "those costs incurred by the buyer . . . of goods, but which are not normally included in prices." (4, p. 10).
Efficiency in producing these services is of concern to consumers whether production is publicly or privately provided.

Outdoor recreation, especially those forms requiring extensive tracts of rural land, are by definition not producible where markets exist. Increasing urbanization and the increasingly intensive use of the urban periphery has left little suitable land for recreation within easy reach of the majority of consumers. In addition, most of the extensive recreation areas such as state parks and forest camps provide the highest quality settings only when located in extensive wooded country, preferably including recreation water and rolling to steep terrain. As intensive land uses have been pushed to greater distances from metropolitan areas, the remaining sites suitable for recreation have likewise become fewer and more distant from users. The transfer cost, borne in this case by the users, has become the principal "price" to the user for consuming recreation service. Public recreation has, by tradition, been provided for only nominal prices or free of use charges at the site.

In the demand studies cited above, the authors have recognized that this transfer cost serves effectively as a price to consumers in rationing their purchases, according to their willingness to pay (travel). They have all followed the suggestion first made by Hotelling in a letter to the Director of the National Park Service contained in the "Prewit Report." (18)

Clawson developed this idea most fully in demonstrating a method for estimating the demand for and value of National Parks (6). He recognized in his study that the principal costs of the trip were travel, fees for admittance, and the extra meal and lodging costs which would not have been
incurred at home. For purposes of simplifying the data handling and lack-
ing sufficient data, he chose a cost dependent on distance travelled as
a surrogate for price in developing demand curves for the recreation ex-
perience. Clawson admitted that this choice of cost probably under-
estimated the total price as viewed by consumers. He particularly men-
tions time costs, omitted because of near impossibility of estimation.
Further, it is not known whether for consumers the time, or the travel
itself, is viewed as costly or rewarding. These factors are no doubt
viewed as rewarding by some and as onerous by others. In any event, it
remains clear that the out-of-pocket travel costs must act as a price as
viewed by consumers in planning recreation trips (6).

We can now see clearly the difference between those services which
are market oriented—call forth little or no transfer cost by buyers—and
most outdoor recreation service which is resource oriented. Since public
recreation is provided at little or no price at the site, the rational
consumer will choose those recreation purchases which at least equates
his satisfaction with the transfer and other variable costs for the trip.

If public agencies were charged with providing recreation at minimum
cost to consumers, ignoring on-site production costs, new sites should be
developed as close as possible to consumers, market oriented. However,
other constraints in addition to scarce available resources are at work.
Public agencies are also expected to provide desired levels of service by
the most efficient use of their limited budgets. This means that the fac-
tors of production—land, labor and capital—must be combined to produce
services at the least obtainable cost.
If public agencies were to concentrate their planning efforts toward providing recreation service of those forms and locations which would minimize their costs for land, capital improvements and operating funds, they might choose locations which require very high transfer costs by users.

The relationship of these costs may be visualized by reference to figures 3, 4, and 5. We would hypothesize the shapes of these three curves as shown for a spectrum of recreation developments ranging from close-in urban parks to the most distant wilderness areas. The most costly land and most intensive capital improvements are found in urban parks, closest to the users. Forest and wilderness areas, the lowest valued land, typically receive the lowest inputs for development and operation. The trend of transfer costs is logically related to the distance from most users to typical choices of each type of development. Obviously for many users in eastern U.S. the transfer cost to reach wilderness areas and national parks would be much greater than indicated.

Proof of these hypothesized trends for land and development costs can be seen in the relationship shown in Table 1 and Figure 6. The area-types (from the Washington State plan) were chosen which most closely matched the developments on the graphs above. The regional area type is representative of county parks and state recreation areas. Fresh water shorelands are typically small parcels of land with minimum developments for use and access. Since both this area type and regional areas are normally waterfront oriented, they exhibit fairly high costs per acre. Regional areas usually are larger (a typical size is given as 750 acres) and include only a small proportion of water frontage, which accounts for their smaller average land cost per acre. Forest and mountain area types are largely in
Fig. 3  Trend of land costs with recreation areas at increasing distance from urban centers.

Fig. 4  Trend of development costs with increasing distance from urban centers.
Fig. 5 Trend of transfer costs with increasing distance from urban centers to selected recreation areas.
Table 1. Standards, cost per acre and per 100 peak-day users for sample area types. (49)

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Acres/100 users^a</th>
<th>Sphere of Influence</th>
<th>Land Cost/ Acre^b</th>
<th>Cost per 100 Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Large urban</td>
<td>3.5</td>
<td>25</td>
<td>$10,000</td>
<td>35,000</td>
</tr>
<tr>
<td>2. Regional</td>
<td>23.6</td>
<td>75</td>
<td>1,000</td>
<td>23,000</td>
</tr>
<tr>
<td>3. Fresh water shorelands</td>
<td>6.0</td>
<td>100</td>
<td>2,000</td>
<td>12,000</td>
</tr>
<tr>
<td>4. Mountain or forest</td>
<td>1600.0</td>
<td>100</td>
<td>5^c</td>
<td>8,000</td>
</tr>
</tbody>
</table>

^a A measure of capacity based on peak-day use.

^b The first three figures are approximate averages for the state, for 1967. Costs were estimated for most of the 13 state regions and showed considerable variation by region.

^c Value based on the assumption that multiple use of most of these lands will be practiced and that recreation will reduce by 5% the full production potential of land averaging $100 per acre in present value. No estimates were available in Technical Report II.
Fig. 6 Development cost per acre for typical samples of area types in Washington (49, Table 1, p. 8).
public ownership except in a few western counties. These lands (whether public or private) are managed largely for multiple uses and include minimum areas devoted exclusively to recreation. Wilderness areas, providing a part of the inventory of the mountain area type, are an exception to this management practice. However, no estimate of need for wilderness was made in the Washington plan. No land costs were estimated for these two area types (49).

In order to understand the proper relationship between user's transfer cost and agency costs to provide service, we must examine agency costs in terms of service units. Again we turn to Table 1 and Figures 7 and 8. Washington planners have developed in their standards study the acres needed to serve 100 peak-day users on each area type. From these standards combined with per acre costs we have developed costs per 100 users for land, Figure 7, and development, Figure 8.

Land costs show the expected downward trend from urban toward forest area types. Development costs, however, show a mixed picture with no clear trend associated with distance from home. There is another complication which biases this picture of cost relationships. Acres per 100 peak day users is a measure of capacity, not use. Were we to secure year-long estimates of use for these typical area types, we could examine cost estimates in terms of visitor days of use. Two characteristics of use patterns would tend to modify the apparent relationships of Figures 7 and 8. Areas close to consumers tend to be used oftener and for shorter time periods, thus peaking of use is not so severe. Regional areas are typically used very heavily on weekends, less on weekdays. Further, the season of use related to weather is much longer for urban parks, shortest
Fig. 7 Trend of land costs with use intensity for sample area types. (Data taken from PCAA Technical Report II [49].)
Fig. 8 Development cost per 100 peak-days users on typical area types in Washington (49, p. 8).
for forest and mountain areas. These two characteristics would tend to lower land and development costs on a visitor day basis for those area types with longer seasons and more even flow of use.

For the relationship of operation and maintenance costs to units of recreation service, we refer to reports available from a U.S. Forest Service study and to a planning memorandum for the Washington Parks and Recreation Department. A study of cleaning and policing cost was conducted in 1967 on four representative ranger districts in Region 5 (California) to determine the cost to clean campgrounds to a 100% or "acceptable" level (29). Costs also included administration and enforcement of fee collection under the Land and Water Conservation Fund program. Summary of costs per family unit were reported for the four districts and averaged $60.00 per season per unit and $0.30 per unit per day. No data were provided which would enable us to estimate costs on a visitor day basis. However, volume of business (visitor days of use) was recommended as a basis for the relative budgeting by districts to provide comparable cleanup and policing levels (29).

Park planners in Washington presently use a benefit cost appraisal in evaluating park plans, which specifies standard rates for calculating annual costs (Washington Parks and Recreation Department, undated). These annual costs are estimated for maintenance, at 3% of development cost; operation (custodial and surveillance) at 12 cents per annual visitor; and for depreciation at .05743 times the total acquisition and development cost for a 25-year life expectancy.\(^1\) (49)

\(^{1/}\) This rate will repay these costs plus 3% interest.
It is not possible to compare the operation cost (12 cents per visitor) directly with the Forest Service figure of 30 cents per family unit. Family units have been found in numerous surveys to be used by groups averaging four persons. Thus the apparent cost to the Forest Service is seven and one-half cents per visitor day. Since the Forest Service figure is prorated on family units without regard to occupancy, the apparent cost is not truly based on visitor days of service. (Unless, of course, occupancy is close to 100%, season long. Occupancy rate was not reported.)

The practice by state park planners of charging a fixed per cent of development cost (3%) to cover maintenance costs is clearly only a rule of thumb. This completely ignores the possibility that some more costly forms of development may require less maintenance than cheaper ones—a common observation as applied to such permanent structures as roads, buildings, signs, et al.

At any rate, data are not at hand to hypothesize any clear trend in maintenance costs, as related to visitor days of service. They may relate in the same general manner as development costs, at best in a rather indeterminate fashion.

We may conclude from this review of administrative costs that the relation between the type of service and cost per visitor day is a weak one, showing no clear tendency to increase or decrease with distance from home. If this hypothesis is true, then the transfer cost incurred by visitors becomes more critical in determining the location of new investments for several classes of outdoor recreation service.

The above discussion has focused on possible differences among classes of recreation service (area types) for four kinds of costs: land,
development, operating (O and M) and transfer costs. It is the premise of this study that any efficiency comparisons must include analysis of all of these costs in seeking to maximize the benefits from development programs. While it may prove fruitful to examine differences in total costs between classes of recreation service, the total amount of each class of service to be offered will likely be determined primarily from estimates of need for various area types.

In Washington—and in most states—there exist many potential undeveloped sites which could provide increased supplies of most classes of recreation service. Efficiency gains can be identified and exploited only by a thorough analysis of several possible sites within each planning region and for alternate plans for each site. Comparisons would logically be made within service classes to serve a given clientele—sphere of influence.

In the following chapter we will develop the detailed form of the efficiency element which will be used to estimate D and D* (costs per visitor day for the proposed project, D and the least cost site D*) as required in the scoring model.
This chapter will develop the logic and structure of the efficiency model. Variables will be identified and explained. The method for reporting evaluations of quality and efficiency will be presented.

The Basic Model

The basic model proposed for evaluating and comparing competing proposals as developed above, is restated here:

\[ S = Q^* + E^* \]  \hspace{1cm} (4.1)

where

- \( S \) = the ranking score
- \( Q^* \) = the quality score
- \( E^* \) = the efficiency score

Development of the quality score, \( Q^* \), has been explained using the concept of facets of quality, evaluated by assigned teams of qualified examiners. Provision has been made for policy decisions governing the appropriate weighting of quality, \( Q^* \), and efficiency, \( E^* \).

The efficiency element has been defined by the expression:

\[ E^* = E \cdot \left( \frac{D^*}{D} \right) \cdot 100 \]  \hspace{1cm} (4.3)

where

- \( E^* \) = the efficiency score
- \( E \) = an assigned weight, \( 0 < E < 1 \)
- \( D^* \) = minimum cost per visitor day achieved within the region and service class
- \( D \) = cost per visitor day estimated for proposed project

Actually the definition of \( D^* \) may be some arbitrarily chosen base level, slightly below the minimum achieved in either the region or in the
entire state system of developments for the given area type. The latter choice would provide for comparisons of efficiency over all state recreation areas, or all forest camps in the state. However established it should provide a numerator such that the most efficient proposals will achieve a value close to unity for the fraction D*/D.

The calculation of both (D and D*) is achieved using this basic model:

\[
D_j = \frac{\sum C_i j}{G_j + H_j/2} \quad (i = 1, 2, \ldots, 5) \quad (5.1)
\]

\[
D_j = \frac{\sum C_i j}{G_j + H_j/2} \quad (j = 1, 2, \ldots, J)
\]

where:

- \(D\) = cost per visitor day, $\
- \(j\) = year of estimated cost\
- \(C_i\) = classes of cost as follows:
  - \(C_1\) = annual land cost (rent)\
  - \(C_2\) = annual costs (rent) of capital developments having indefinite life\
  - \(C_3\) = annual depreciation of capital developments having a finite life\
  - \(C_4\) = annual operating costs\
  - \(C_5\) = costs for visitor access\
- \(G\) = estimated visitor days attendance, campers\
- \(H\) = estimated number of day-visitors

Since equation 5.1 is the general form covering selected years (j) and since the individual calculations will normally be made for one year at a time, a more convenient form for equation 5.1 is as follows:
Discussion and Calculation of Variables

Since it is the purpose to develop costs for expected annual use for given years, it is necessary that all costs be inserted in equation 5.1a with a common time base. This will require the use of discounting in order to achieve a common base for the final calculation. This base is specified as the start of the first year of planned service for each proposal. The following discussion will clarify development of the 5 classes of cost enumerated above.

Annual land costs, $C_1$.

Annual land costs in effect involves an annual rent charge based on the appraised value of the land which can be expected to yield an acceptable interest rate of return. Another cost in providing service from developments which require some time period to bring into service is the cost involved in tying up appropriated monies for land values dedicated to future use during the period when construction proceeds and prior to the date of service. This time period is often called the gestation period. Annual rent may be calculated as follows:

$$C_1 = V_o (1 + p)^g \ (p) + a(1 + p)^g$$

(5.2)$^{1/}$

where

- $C_1$ = annual land cost
- $V_o$ = current value of all land and land rights

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$^{1/}$ All compound interest formula and notation have been adapted from Davis (10).
\( p \) = interest rate in decimal form
\( g \) = years from project funding to first year of service
\( a \) = annual rent paid for project land rights from date of project funding, indefinitely

Development costs of permanent improvements, \( C_2 \).

These improvements are those which must be maintained in their original condition. Examples include all grading and land shaping, roads, landscaping, parking lots, et al. These costs will be treated identically with the first term of equation 5.2.

\[
C_2 = (1 + p)^g (p) \sum E_k k (k = 1, 2, ..., K) \tag{5.3}
\]

where
\( C_2 \) = annual costs of all permanent developments
\( E \) = permanent investments
\( k \) = classes of permanent investments
\( p \) and \( g \), as in equation 5.2

Development costs of improvements with a finite life, \( C_3 \).

These investments include such items as buildings, docks, fences, and barriers, et al. for which Washington agencies estimate a life of 10 - 25 years with no salvage value. In developing the \( E \), all investments which share a common life expectancy (\( f \)) will be aggregated. Thus the \( f \) signifies both a group of investments and the years of life for computing annual depreciation. For some plans short life equipment such as vehicles may be budgeted on an annual depreciation basis and would be grouped as one of the \( E_f \). Some shorter lived improvements such as picnic
tables, signs, and maintenance equipment which are budgeted for annual replacement schedules will be included in $C_4$ costs.

Calculation of $C_3$ costs will be accomplished as follows:

$$C_3 = (1 + p)^6 (p) \sum_{f}^{E} \frac{(1 + p)^f}{(1 + p)^f - 1}$$

where $C_3$ = annual charge (depreciation) for improvements expected to last $f$ years

$E$ = initial cost, in place, of these investments

$f$ = expected life of investments, years

$p$ and $g$, as in equation 5.2

Annual costs for operation and maintenance, $C_4$. These costs are normally predicted for 2-year periods and are authorized during the biennial meetings of the legislature. However, they are not normally committed until the year of actual expenditure and thus require no discount treatment. They are inserted in the model as estimated for the required year of service. These costs must include the following categories:

1. Personnel--wages, salaries, and travel.
2. Supplies.
3. Services and rents (contracts, utilities, etc.).
5. Maintenance of permanent structures (this may be included under 1 and 2).
6. Overhead: supervisory office, social security, hospitalization, retirement benefits, etc.

7. Other.

For inclusion in the basic model these will appear as follows:

\[ C_4 = \sum_a C_{4a} \]  \hspace{1cm} (a = 1, 2, \ldots, 7)  \hspace{1cm} (5.5)

where \( C_4 \) = annual costs for operation and maintenance
\( a \) = the seven categories of cost listed above

Costs for visitor access, \( C_5 \).

This component of cost will be the sum of all vehicle travel costs incurred by visitors from home to the site and return, during the year of prediction. The equation for calculating this cost is:

\[ C_5 = 2 \sum_q (NMK) \]  \hspace{1cm} (q = 1, 2, \ldots, Q)  \hspace{1cm} (5.6)

or

\[ C_5 = 2K \sum_q (NM) \]  \hspace{1cm} (q = 1, 2, \ldots, Q)  \hspace{1cm} (5.6a)

where \( C_5 \) = total visitor cost for the desired year
\( q \) = defined access zones for which estimates are made of:
\( N \) = number of vehicle trips per year
\( M \) = road miles from center of access zones
\( K \) = cost per vehicle mile for each zone
\( 2 \) provides for round-trip costs

Since \( K \) may be considered a constant for all travel zones, it will prove simpler to use equation 5.6a.

The concept of access zones, \( q \), is to accommodate the prediction of patronage for a proposed site from particular market areas. Previous
studies of developments similar to cases being analyzed will be most helpful in identifying characteristics such as distance traveled, area of origin, length of stay, and occasion for particular trips. The M in each calculation for a particular access zone may be calculated alternatively using population centroids for market areas, or for existing developments through the use of travel distance reported by interviewed visitors. The number of vehicle trips required to account for the rate of visitation from each zone or market area must be analyzed separately.

The estimation of expected use of a new development is most easily made by analysis of use patterns at similar existing attractions. This analysis will be most useful if expected use can be expressed in relation to design capacity. This relationship is expressed in the following equation:

\[ U = \frac{NLP}{XYZ} \]  

(5.7)

where

\[ U \] = use as a fraction of capacity

\[ N \] = number of vehicles admitted per season

\[ L \] = average length of stay, days

\[ P \] = average number of persons per vehicle

\[ X \] = project capacity in units

\[ Y \] = average number of persons per occupied unit

\[ Z \] = length of season, days

Data secured at most state parks where fees are charged would provide sample estimates of most of the independent variables. Studies may be needed to establish L, length of stay and P, persons per vehicle. The Washington Department of Parks and Recreation (DPR) presently enforces a
"one vehicle per camping site" rule. Thus values for \( P \) and \( Y \) will be the same for a given park.

**Camper access costs.** Using the above relation we combine equations 5.6a and 5.7 to provide the operating form for calculating costs for camper access:

\[
C_5^c = 2KUXZ \sum_{q} \left[ \frac{(Y)}{(LP)M} \right]_q^q (q = 1, 2, \ldots, Q) \quad (5.8)
\]

where \( C_5^c \) = total cost of camper access

K,L,U,X,Y and Z as defined above

\( q \) = market areas for which estimates are made of:

\( M \) = miles from market area center to the site

\( J \) = fraction of visitors from market area \( q \)

The \( Y,L \) and \( P \) are included within the bracket to provide for variations among zones. The present state of knowledge is such that these variations can now only be guessed at, though it seems reasonable to expect a relationship to exist between distance and length of stay, frequency of multicar groups and possibly persons per car. If predictions are made using average values for \( Y, L \) and \( P \), they may be shifted outside the bracket.

**Day user access cost.** Problems are encountered in estimating use rates for day use capacity. Here capacity is difficult to define since it involves a variety of activities and parking areas. Also, there is known to be a fair degree of turnover (entering and exiting) during the day, so that a given capacity, however defined, may easily serve more than this number of persons per day. For practical purposes a visit may
be defined as any visit lasting one hour or more (but not overnight) to eliminate those visits which involve little or no use of facilities, other than road travel within the park.

The 1969 Washington Statewide Comprehensive Plan has defined capacity in terms of space requirements for typical activities in the Regional area type (49, pp. 46-48). This type is exemplified by major state parks and county parks. The following table 2 may be used as a guide for estimating the capacity of day use areas of proposed developments of this class.

Actually the usefulness of this table is to provide guidance in allocating space to various areas within a given development. In terms of meeting peak loads, parking space will usually prove to be the limiting factor which results in turned away visitors. We know that the overwhelming majority of visitors to state and county parks travel in passenger cars and similar capacity recreation vehicles. It appears that table 2 shows an unrealistic capacity for peak day users since parking is limited to 1,000 for campers and 800 for all other (day) users. It is obvious that the capacity of parking lots should not exceed the capacity of activity areas to accommodate safe numbers without undue crowding. Planners must attempt to achieve a balance between the capacity of activity areas and parking space.

Providing this balance is achieved, we can obtain estimates of $N_1$, number of day use vehicles expected per season by the following:

$$N_1 = \left[ Rw_1 + (Z - R) w_2 \right] \cdot X_1 T$$

(5.9)

where $N_1 =$ number of vehicles admitted per year for day use
Table 2 Standards for regional area type developments (49, p. 48).

<table>
<thead>
<tr>
<th>Activity</th>
<th>No. Users per Facility</th>
<th>No. Fac. per acre</th>
<th>Turnover rate per day</th>
<th>Total No. Users per Day/Acre</th>
<th>No. Peak Day Acres</th>
<th>No. Peak Day Users</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PASSIVE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Meadow</td>
<td>10</td>
<td>1</td>
<td>3</td>
<td>30</td>
<td>20</td>
<td>600</td>
</tr>
<tr>
<td>Natural Areas</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>15</td>
<td>30</td>
<td>450</td>
</tr>
<tr>
<td>Picnic Areas</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>36</td>
<td>20</td>
<td>720</td>
</tr>
<tr>
<td>Camping Areas</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>20</td>
<td>50</td>
<td>1,000</td>
</tr>
<tr>
<td>Landscaping</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Buffer @ 75%</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking Areas</td>
<td>--</td>
<td>100</td>
<td>2</td>
<td>200</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td>Trails and Roads</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>12</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>746</td>
<td>2,770</td>
</tr>
<tr>
<td><strong>ACTIVE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Play Area</td>
<td>10</td>
<td>3</td>
<td>6</td>
<td>180</td>
<td>1</td>
<td>180</td>
</tr>
<tr>
<td>Field Games</td>
<td>25</td>
<td>2</td>
<td>2</td>
<td>75</td>
<td>3</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>405</td>
</tr>
<tr>
<td>Totals for Regional Area Type</td>
<td>750</td>
<td>3,175</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Acres per user = \( \frac{\text{No. of Acres}}{\text{No. of Peak Day Users}} \) = .236

Acres per 100 users = 23.6
R = number of peak days per year
X₁ = capacity of parking for day use, cars
T = turnover rate
w₁ = % of capacity expected on peak days, a decimal
w₂ = % of capacity expected on non-peak days, a decimal
Z = season length, days

Equation 5.9 assumes that predictions will be made directly in units of cars. It may be preferable, where past records are kept in persons, to express predictions in this unit. In this event, separate estimates of persons per car would be made by sampling studies at typical regional areas. With estimates in units of persons, equation 5.9 becomes:

\[ N₁ = \left[ Rw₁ + (Z - R)w₂ \right] \cdot \frac{X₁T}{P₁} \]  

(5.9a)

where
X₁ = capacity in persons for day use
P₁ = persons per car

Other symbols as in equation 5.9

We may now state the relation for calculating the day use component for visitor access cost, using equation 5.9a for computing N₁, as follows:

\[ C₅d = 2K₁ \left[ Rw₁ + (Z - R)w₂ \right] \cdot \frac{X₁T}{P₁} \sum_{s=1}^{S} (M₁J₁) s \]  

(5.10)

\[ (s = 1, 2, \ldots, S) \]

\[ \sum J₁ = 1.00 \]

where
C₅d = total costs of access for day visitors
K₁ = cost per mile for day visitor travel
R = number of peak days per season
w₁ = percent of capacity used on peak days, average
\[ Z = \text{season length, days} \]
\[ w_2 = \text{percent of capacity used on non-peak days} \]
\[ X_1 = \text{capacity in persons at one time} \]
\[ P_1 = \text{persons per car, day visitors} \]
\[ M_1 = \text{average travel distance for zone } s \]
\[ J_1 = \text{fraction of total use from zone } s \]
\[ s = \text{zones or market areas of expected clientele} \]

The above discussion focuses on the problem of predicting visitor access costs for two kinds of visits, day and overnight. Areas devoted to serving these two kinds of visitors are largely separated on a given development, though some facilities will be shared. Since charge rates for the two kinds usually differ, it is customary for agencies to record them separately and estimate future attendance for each kind individually. Further, the sphere of influence for camping visitors is much larger than for day visitors, necessitating a different zonal allocation of predicted visits.

Two questions immediately come to mind in light of the above problem. Are visitor days for campers and day visitors truly additive? Are costs for providing service different for the two kinds of visitors? Intuitively, we would likely answer the first question, "No," and the second "Yes."

We have defined day visits to be one hour or more but not overnight. The average length of time probably ranges between three and six hours for most developments. The standards table shown above indicates a turnover rate of at least two for day use facilities, indicating that average visits could be counted at the rate of one-half visitor day. It is
acknowledged that this assumption should be subjected to study, especially in relation to identified market areas for particular development proposals.

As regards the second question, the author believes that any discussion of the relative costs of providing space, facilities and service for the two kinds of visitors would reveal a wide divergence of opinion among planners and managers. Day visitors are often alleged to require closer supervision, e.g. lifeguards at beaches, ranger patrol over game and other activity areas. One often hears the complaint that clean-up after picnickers and day visitors in general is much more demanding than for campers. On the other hand, land costs for campers is obviously higher since nearly twice the space is required per user (see table 2). The obvious difficulty in allocating the daily operating costs and joint facility and land costs, not to mention overhead charges among the two kinds of use, effectively prevents us from making separate cost estimates for cost classes C1 through C4. The operating version of the basic model will adopt the assumption that two day visits are equivalent to one visitor day.

The Efficiency Model in Operational Form

It is appropriate at this point to collect the several calculations of costs into the operational form for calculating costs per visitor day. It will be recalled that this equation will be applied to individual proposed developments, or to existing developments, for chosen years. The basic operational form of the calculation consists of five cost terms, summed and divided by estimated total visitor days to yield the estimated
total cost per visitor day:

\[
D = \frac{C_1 + C_2 + C_3 + C_4 + C_5 + C_5_d}{G + H/2}
\]

where

- \(D\) = cost per visitor day, $
- C_1 \) through \(C_5\) are as defined in equations 5.2 through 5.10, above
- \(G\) = visitor days, campers
- \(H/2\) = visitor days, day visitors

The Efficiency Score

The basic premise of this paper is that choices of favored investments are made on comparative grounds. While the estimated costs, expressed per unit of service (visitor day) have interest and utility as absolute values, the concern of decision makers is in comparing one project with others, or with the "best" that can be conceived. Therefore, we have developed a system which provides for relative scoring based on quality and efficiency.

The calculation of \(D\), cost per visitor day leads to a ratio comparison with \(D^*\), which is some chosen base value representing the most efficient development known in the service class. The first step in the adoption of such an evaluation system would be to develop values for \(Q^*\) and \(D\) for existing developments, systemwide. While such an analysis of existing sites would identify opportunities for improving quality and efficiency at these sites, its primary purpose would be to give a basis for evaluating new proposals. As suggested above, the choice of \(D^*\)
might be made to represent the best available examples from such an
analysis, or it could be a composite hypothetical value, combining the
best examples of each of the five classes of cost. However derived, the
d\* value provides the base for calculating the efficiency element of the
final rating. The relationship restated here is:

\[ E^* = E \left( \frac{D^*}{D} \right) \times 100 \]  \hspace{1cm} (4.3)

where
- \( E^* \) = the efficiency score
- \( E \) = the assigned weight, \( 0 < E < 1 \)
- \( D^* \) = cost per visitor day, a norm
- \( D \) = cost per visitor day of subject development

Reporting Evaluations: The Choice Instrument

The decision-making agency in Washington (IAC) is made up of 11
members, six state agency heads, and five appointed by the governor rep­
resenting the public. This committee is responsible for guiding and shap­
ing the broad policies of the state dealing with recreation planning,
funding, and development. Management of various state resources is as­
signed by law to the several state agencies described earlier. The IAC
is advised by its technical committee consisting of representatives of
state, federal, and local agencies. The conduct of IAC affairs is largely
delegated to a small permanent staff which plays an active role in all
technical committee actions.

The several state agencies submitting plans for capital spending
from the recreation account will be developing these project plans on a
continuing basis. At appropriate times, biennially, the IAC calls for
submission of proposals from these agencies for review and selection of
priority projects for the next round of funding.

The process of evaluating the quality and efficiency of proposals is an integral part of site development planning. As plans reach the final stage for within-agency review, the evaluation model will be employed to incorporate the planner's ratings of quality and efficiency.

As plans and their ratings are accumulated, first at the district or regional level, later at the state office level, the need develops to compare critical elements of the plans with others which are competitive for priority selection. At this point, it will be helpful to begin listing all plans which the agency planners believe should be considered on a form which permits rapid comparison of the critical elements of each plan. Such a form is suggested below, Form 5.1. The form permits the addition of plans as they accumulate (by extension to the right, more columns may be added).

**Discussion of the comparative evaluation form 5.1.**

This form is intended for use at several stages of plan development. The region or district offices will initiate these comparisons for their own use and for reporting to state offices. State level offices of each agency will develop lists embracing one or more regions for each class of development (area type). Finally, these offices will compile their final lists to present and support their selections to the IAC for their review and evaluation.

At each stage, comparisons will be sought on a number of points. The list of these characteristics presented in Form 5.1 is meant to be suggestive and may omit items of interest at particular levels of use.
For IAC review the list may be shortened, omitting some details.

The identifying items of Form 5.1 are self-evident across the top. The site identification box includes a line supplying the rank number based on overall score (S) for ease in identifying high ranking proposals. The first five items evaluated will be the ones most critical in appraising the impact on stated budgets of selecting any given plan. The remaining items will be useful in partitioning the efficiency score. The breakdown of the five cost classes in visitor day terms will reveal the potential trade-offs between cost classes, between plans for a given site as well as between sites. These values will be most helpful in explaining the different ideas incorporated in plans under study. They will also reveal the effect of changes in plans suggested by reviewers for which relevant costs and corresponding changes in use rates can be predicted.
Form 5.1 COMPARATIVE EVALUATION OF DEVELOPMENT PROPOSALS

Planning Region(s) __________________________________ Biennium(s) ____________________________
Area Types ___________________________________________ Cap. Budget, Acq. & Devel. $__________________________

PROPOSALS

Site Name
Plan
Rank No.

1. Overall score (S)

2. Quality score (Q*)
   a) Site quality score
   b) Design quality score

3. Efficiency score \(E^* = \frac{E}{D^*} \times 100\)

4. Years from funding to service

5. Acquis. & devel. $, this budget
   a) Total devel. cost, $
   b) Land acquis. cost, $

6. Total land value, $

7. Total development value, $

8. Capacity (PAOT)\(^a\):
   a) Camping
   b) Day use

9. Attendance (V-D)\(^b\) 1st service year
   a) Camping total
   b) Camping, per unit/year
   c) Day use, total
   d) Day use, per unit/year

10. Attendance (V-D)\(^b\) 6th service year
   a) Camping, total
   b) Camping, per unit/year
   c) Day use, total
   d) Day use, per unit/year

11. Average costs/V-D, first plus sixth years; total
   a) Land use, cost/V-D
   b) Developments, total, cost/V-D
   c) Operation & maintenance, cost/V-D
   d) Visitor access, cost/V-D, all visitors
   e) Visitor access, cost/V-D, day visitors
   f) Visitor access, cost/V-D, campers

12. Base cost/V-D, (D*)

\(^a\) PAOT = persons at one time

\(^b\) V-D = visitor days
CHAPTER VI. DATA FOR TESTS OF THE MODEL

Site Planning and Construction by State Agencies

This chapter will provide the background information concerning the tests of the system. Project planning methods of the two Washington agencies will be discussed. The quality and availability of data secured will be appraised. Finally the programming of the efficiency model will be described.

Prior to the start of this study the author contacted state office division chiefs in each of the three major land managing agencies and staff members of the IAC, to acquaint them with the purposes of the study and to solicit their help. All appeared cooperative and interested in helping in any way.

In discussions with Game Department officials it became obvious that formalized planning for site development and management was almost non-existent. Those facilities which had been provided in limited numbers had resulted from initiative at the district level in response to observed concentrations of use, mostly along fishing streams, or lakes. Most of these improvements consisted of minimal road access, trash cans and pit toilets. Only three or four sites had been equipped with stoves and shelters. I was told that there is no specific budgeting for this kind of development. Rather, these improvements had been accomplished, using management labor and materials acquired with operating funds. This discovery forced a decision to omit the Game Department as a source of case data for this study.
It was originally hoped that the IAC might have plans on file which could provide needed data for analysis. However, it became apparent that the small staff of the IAC precluded their having intimate knowledge of agency site plans. Further, they would have only limited time available to assemble the supporting information needed. I was encouraged to rely on the agencies themselves for the degree of detail required. This resulted in contacts with the planning and operating personnel in the Olympia offices of the two departments: Natural Resources (DNR) and Parks and Recreation (DPR).

Discussion with these planners led to a listing of sites in two planning regions for which planning had been accomplished recently. From these lists a choice was tentatively made of three sites from each agency for each region, 12 in all. Initial plans for all 12 had originated from a major planning effort, the result of a planning grant by the Housing and Home Finance Agency under the so called 701 program by the federal government to stimulate comprehensive state-wide planning. In all 12 cases the original plans had been revised and updated. Most were currently (summer 1969) included in budget askings or had been approved for initial funding by the 1968 session of the legislature.

The planning offices of both agencies were able to provide summary information on site plans and operating costs. In no case was there any estimate of attendance patterns or any attempt to identify clientele by probable source areas. In the course of exploring these records, it becomes apparent that I would need the help of field planners to interpret the summarized plans and to secure the details required for this analysis. Consequently, arrangements were made to interview field office personnel
in depth. These interviews were conducted during the summer and fall of 1969, requiring two or more visits to each of five offices.

While these two agencies share a number of characteristics, they differ in important respects and will be discussed separately below. Both agencies have a common form of organization with a central office in the capitol city of Olympia. These offices are charged with developing overall policy, management coordination and system wide planning. Each office houses several functional divisions with both line and staff responsibilities. The line functions are carried out by field offices through a district administrator (DNR) or regional supervisor (DPR).

**Department of Parks and Recreation**

The Olympia office of the DPR houses four functional divisions: Administrative, headed by the agency director; Consultation - Education; Operations; and Planning and Development. The last two divisions supervise the field staffs of three regional offices. These three offices in turn provide the administrative link to the developed and operating parks and are responsible for the field planning and engineering supervision of all new developments.

The planning activities at this level require the services of experienced park planners, engineers and draftsmen. Many of the day-to-day problems of park management are reported to the regional supervisor. The staff is rather small, consisting of 5-8 professional positions and perhaps twice this number of technical personnel. A major responsibility of this group is the development of initial budgets for capital spending and operating funds. Detailed study of plans for the sites selected
earlier, was made at two of these regional offices. Interviews were ar-
ranged with the two regional planners, requiring several days in each
case.

**Department of Natural Resources**

This department is headed by the Commissioner of Lands, an elected
official. Overall administration is delegated to an appointed supervisor.
There are nine functional divisions which handle the planning and super-
vision of the various management activities. The management program
embraces a wide variety of resource developments and uses on approx-
imately two million acres of forest land and another million acres of
range and crop land.

At the present time recreation is not represented among the operat-
ing divisions. Recreation planning and policy guidance have been en-
trusted to a technical assistant to the commissioner. Site planning and
management are accomplished at the district level by engineers and
foresters with minimum guidance from the small staff of the technical
assistant. This is a reflection of the policy that recreation service
must be considered essentially a by-product from lands managed, by law,
for maximum income to the people of the state. Developments for recrea-
tion service have so far been justified primarily as a part of the de-
partment's responsibility to protect their resources through control of
use. In 1968 authority was granted the commissioner to add a recreation
division to supervise the expanding program of development and operating
activities in the face of rapidly rising demands by the public for use
of these extensive lands.
Field activities of the DNR are supervised from 23 district offices. The handful of professional specialists in each of these offices is made up of foresters, engineers and range managers. Their principal activities center on the management, protection, harvesting and sale of products from the lands. Their training and experience have not equipped them (with rare exceptions) to plan for or deal with the consumer service aspects of recreation management. The three administrators (all foresters) with whom I discussed plans all evinced a common sense, pragmatic approach to planning and management of recreation developments. They were, in contrast to professional planners of the DPR, much more willing to seek advice and suggestions from user groups and experienced professionals in identifying high priority areas and development needs. Their approach to selecting the style of physical improvements (roads, tables, toilets, etc.) was strongly cost conscious. In general they tended to favor the simplest designs and minimal road costs. The scale of developments was also uniformly small. The most recent and largest plan to date (constructed in 1969) was for a 15-unit campground. This is consistent with the authority granted in 1967 "to construct, operate and maintain primitive outdoor recreation facilities...." (24).

Two of the three district offices providing data, have recently secured the services of men assigned full time to recreation management. While they work closely with district personnel, their work is partly directed by the staff in the Olympia office and is spread over two or more districts, as needed. Their work involves supervising the operation and maintenance activities, with the assistance of temporary recreation aids (college students) during the summer season. They also perform
field investigation for proposed new developments. They have little or no responsibility for actual construction and development.

In all three offices, the district administrator took an active part in the development of plans and proposed operating budgets. In one office the district engineer had taken a responsible part in both planning and development construction though had less interest in or knowledge of operating budgets.

A major difference between the two agencies was evident in the degree of detail revealed in plans. For several reasons the DNR site plans were extremely simple drawings of the proposed developments. Plans for state parks, on the other hand, showed the talents of engineer drafting, blueprints for structures, water and sanitation systems and detailed specifications for roads, parking lots, paths, barriers, etc. This contrast reflects the differences in scale, intensity of development, and degree of service commonly associated with state parks as opposed to forest camps. Another major reason for the low degree of detail in planning in the DNR is due to the custom of handling construction by force personnel and the consequent opportunity to settle many construction details as work progresses. This also allows a flexibility in plan execution to meet unforeseen contingencies not visualized in the somewhat casual planning phase.

On the other hand, the scale of development at state parks plus the need to specify all details of design and construction for contract letting require more and varied skills and effort in the planning process. A further result is that capital budgeting is far more rigorous in the DPR than for the DNR.
An interesting attitude was revealed by men in both agencies toward federal share funding of recreation developments. In both cases they revealed a strong bias against the Land and Water Conservation Fund program as severely curtailing flexibility in plan execution. In the absence of the constraint of a rigid plan on file with the BOR, plans can be modified as changes in technology and shifts in identified needs occur, between the time the plan is submitted and actual construction activity. Both agencies (field personnel, at least) feel that the L & WC Fund program should be used mainly for assisting land acquisition programs. In the case of the DNR, it was admitted that, in some cases, it was possible to "bury" some construction costs in operating budgets since operating crews can be assigned to development tasks "in their slack time." As a result of this admission, the author took particular pains to secure cost estimates for construction plans which fully reflected the probable total costs with proper accounting.

The Data Secured

The plan for this study called for securing plans for new or expanded developments in two of the thirteen planning regions of Washington. It was hoped that several sites for each of three kinds of developments could be studied typifying: (1) state recreation areas, (2) forest camps, and (3) traveler camps. None of the state agencies plans for service to travelers as a specific category or style of development. Several state parks and a few forest camps do, in fact, provide this service by virtue of location near heavily traveled routes. In the last few years there have been a number of private campgrounds developed near major travel
routes and larger cities. There appears to be a growing feeling among the public agency administrators that this overnight service should be supplied primarily by the private sector, since they are better equipped to offer the kinds of service being demanded, e.g. advance reservations, proximity to commercial food and vehicle service, et al. Therefore, it was decided to concentrate on the first two service classes in selecting sites for proposed development by the two state departments.

In selecting the two regions for which sites would be examined, several factors were considered. Physiographically and demographically, there are two major areas of the state divided along the north-south line of the Cascade Mountain crest. The west side exhibits a moist Mediterranean climate with yearlong rainfall and contains about 73% of the population (46). Recreation attractions are strongly oriented to the shoreline of Puget Sound or the Pacific Ocean and to the nearby mountains. The eastern part of the state, with somewhat larger area and less than half as many people, has a much drier climate with greater temperature extremes, and offers a wide variety of recreation attractions, including mountains, forests, rivers and lakes. Because of the greater variety and the relief from a moist climate, many people from the more populated west side are attracted to east side locations, especially on summer weekends and vacation trips. The reverse flow is present though it is fed by a much smaller population.

For purposes of testing the model it was decided that one region be chosen on each side of the state. Further, we wished to avoid a region where considerable interstate movements were known to exist because of the difficulty of accounting for development plans which might be
competitive, though unknown, by adjoining states. Finally, we eliminated regions for which ocean shore developments would likely be given high priority because of rapidly vanishing opportunities. The regions selected, numbers 5 on the west side and 7 on the east side, are shown with the location of chosen sites in the Appendix.

It will be noted that two of the state park sites are not within the regions chosen. One is on the border of planning region 7, the other in region 1 adjoining region 5. Choice was dictated by availability of plans, and did not seriously violate the constraints placed on the choice of regions.

In each region three state parks and three forest camps were selected for the study of development plans. For all but two of the state parks two plans were evaluated at alternate levels of development. These two were for the expansion of existing sites. Alternate, larger scale plans had been considered by the DPR but no detailed plans developed. In both cases the anticipated demand did not justify considering the larger scale plans at this time.

A total of twelve plans for six DNR sites were studied. Five of these were for single developed sites, the sixth—the Capitol Forest—contained three sites for initial development and eight in the master plan. Much of the cost of the latter plans derived from off-site development of roads and trails serving the complex of camping and day use facilities as well as day visitors not using these sites. While these two plans include a somewhat different set of activities than the other ten plans, they do cater to the same clientele as the two other sites in region 5, thus are logically considered competitive for budgeting.
For 18 of the 22 plans estimates of attendance and operating cost were made for the first and sixth operating years. In reporting cost per visitor day it was planned to average the results for these chosen years in order to offset the effects of probable low attendance during the opening year. The four remaining plans were for expansion of existing forest camps. Attendance and operating cost estimates for these plans for the first year after construction were believed to be representative of average operating conditions for sites already known to the visiting public.

Evaluation of quality for each of the plans was accomplished following the interviews with planners. The rating forms were discussed and explained and planners were invited to consult with colleagues familiar with the sites and the plans in completing the ratings. In actual practice it would be preferable to use ratings from independent appraisers for final evaluation. This was not feasible for the purposes of this study.

The Quality and Source of Estimated Values

During the course of this study the author received a high degree of cooperation from busy professional planners and administrators. Much was learned of the intricacies and arts of planning and budgeting for recreation development and management as practiced by these two agencies. Inevitably, I gained a variety of impressions about the soundness of the estimates given. It is the purpose of this section to discuss these estimates in some detail and to provide a qualitative appraisal of them.
As was expected data for some of the model variables could not be secured from agency experience. The derivation of these estimates will be discussed later in the chapter. I wish now to discuss the data received from the two agencies as a part of their planning process or in specific response to my requests.

Land value

Considerable variety was encountered in estimates of land values, between plans and between agencies. The only recent data on land costs from the DPR covered purchases during the last 6-8 years, for two of six sites. It became apparent that special estimates of land values would be required using current information. The year 1969 was chosen as the basis for all estimated costs and values. The approach chosen for estimating land values was based on the knowledge of planners and real estate agents of "going" prices for marketable properties which most nearly resembled the sites under discussion. In all but one case the sites were located on desirable water fronts (lake or river). These sites are much in demand over all the state and well defined markets have developed for recreation real estate.

Differences were noted between planners in their knowledge of these markets, yet none of them felt unable to supply reasonable rates for estimating values for either frontage or upland (non-frontage) recreation land. One case provided an interesting check on the methods of appraisal used by the DNR, since one of the state park plans covered the expansion of an existing park on land rented from DNR by the DPR. In this case the planner consulted a knowledgeable real estate agent on
going prices for frontage and upland recreation land for the site in question. When these rates were used to calculate the value of the proposed park addition they very closely matched the value calculation of the DNR as the basis for an annual rental charge. This was doubly interesting since this arrangement has been the source of considerable conflict between the two agency heads, on the matter of state policy regarding the use of these trust lands by another state agency.

The DPR makes no reference to land values in its plan proposals. Much land has been acquired without direct appropriation for purchase, other than to add to and block out existing holdings. Lands have been secured from generous benefactors as gifts or sales at less than market value. Several properties have been acquired from water development agencies, including private power companies, public utility districts and federal agencies, e.g. the Army Corps of Engineers and the Bureau of Reclamation. Private companies and public utility districts are required by Washington law to provide public access for recreation to their reservoir shorelines. Federal agencies have usually been willing, as a matter of policy, to turn over selected sites to state agencies which would develop recreation service.

The DNR has identified a land value in each plan proposal. These values appear conservative when compared to a "fair market" appraisal as adopted for this study. In discussion with DNR planners it became apparent that the trend is toward a more realistic appraisal based on "going" prices for two reasons. First, they have chosen to work toward leasing land to other state agencies or to private recreation developers in suitable areas where markets seem to justify these services. Second,
the BOR has now authorized share funding of project costs which include a charge for allocating these trust lands to recreation development.

For the reasons cited above, it was felt that comparisons of plans could be fairly made only by using current, realistic market values in every case. I am satisfied that this objective was achieved within the limits of time and the present knowledge of planners familiar with their properties and nearby market values.

**Annual rent**

This element in the model was provided for cases where land rights were limited to a lease or other temporary allocations. Annual rent was estimated for only one proposal in which a number of development areas were included. Since these developments were of minimal scale, they could be relocated after periods of use as site conditions deteriorated. It seemed appropriate here to allow for land costs on an annual basis.

For the case of the one state park where a rental fee is paid (see above) to the DNR, the market value of the land was used since the preferred policy of the DPR is to secure fee title to all park lands if possible.

**Capital investments**

All development planning requires estimates of costs associated with each kind of construction work. In general these estimates were available for all cases, although some required updating in line with inflation changes since earlier estimation. Care was taken to insure that all costs were in terms of 1969 price levels.
Data secured from the DPR represented considerable recent experience. Developments have proceeded steadily in recent years with the advent of continued funding programs. Many of the components in individual plans are estimated using "standard rate" figures, e.g. a 50-unit camp loop, one picnic unit, a standard toilet building, et al. Figures for these components were consistent within the region though they revealed differences between regions for some. Costs which reflected site peculiarities were those for roads, water development, sewage systems, landscaping and special structures such as museums, docks, etc.

The experience of planners for the DNR was more limited and reflected the much lower level of involvement in recreation service. In all cases, the planning for recreation development was shared rather loosely between engineers, district administrators, the small staff in Olympia and in one case with a recreation aid. None of these men had more than superficial training in design of structures or in recreation planning per se. Because of the primitive nature of developments on the DNR lands a pragmatic approach toward design, based mainly on observation of similar developments on National Forests, resulted in low costs and simple designs. Structures were limited to one-person pit toilets, wood tables and wood or rock barriers. Road designs were of minimum standard, fireplaces were mostly of native rock or of simple metal design. Since all construction was accomplished with force personnel, including structures, considerable latitude was provided for design variations making use of local materials and skills. Much of the hand labor and most of the structures were provided using inmates of the Honor Camps and Youth Camps administered jointly by the DNR and the State Department of Institutions. All of these
factors combine to produce the very low costs estimated for typical DNR developments. In contrast to the DPR, there was little use made of "standard" unit costs except for individual structures such as toilets and boat launch ramps.

One cost which is difficult to quantify consistently is the overhead charge covering investigating, planning and supervision of construction. State park plans on record all showed an estimate of 15% of all construction costs to cover this element. Some of the older plans of the DNR also used this figure. During the period of data gathering the DNR initiated a policy of allowing 40% of estimated construction costs to cover all overhead. Discussion with Wallace Hoffman, Chief of the Division of Lands of DNR\(^1/\), revealed that extensive review of these costs in his agency and in the DPR had recently led to the conclusion that past practice had grossly underestimated the extent of this cost in development budgeting. The DNR's decision to allow 40% was felt to be a more realistic though still conservative estimate.

In the initial compilation of data a decision was made to treat the plans of both agencies alike, calculating these overhead costs at 15% of total construction estimates. This practice was adopted, after receiving several widely divergent estimates from different DNR planners, in the interest of comparability of estimates. The simulation capability of the programmed model will permit alternate assumptions for these costs in any evaluation.

\(^{1/}\)Conference with W. R. Hoffman, December 9, 1969, Pullman, Washington.
The model requires separate treatment of development costs based on expected life. A number of development items are expected to last indefinitely through annual maintenance programs. These include all roads and parking areas, land shaping, landscaping, beach developments, trails and walks and boundary surveys (though not fencing). Also included here are the overhead charges discussed above. For all remaining capital investments a life expectancy must be estimated to permit calculation of annual depreciation costs. No difficulty was encountered in securing these estimates and in most cases this was standard practice in both agencies. Life expectancy in individual cases varied from 5 to 25 years.

**Gestation period**

No difficulty was encountered in recording estimates of time required to complete developments. Most state parks were estimated to require one year from authorization to start of service. For DNR plans the time varied from 1/2 to 2 years. State park plans reported this information regularly when submitted for funding. The DNR planners provided their estimates based on recent experience with similar projects.

A strict accounting of this delay cost applied to land value would require knowledge of either purchase dates or in the case of the DNR, of dates when decisions were made to reserve land from other uses in anticipation of recreational development. This information was not secured for two reasons. It was not generally available. Also, since 1969 values were used and recent appreciation rates for this type of land has been persistently at or near 10% annually, the effective holding costs for land allocated or purchased earlier would have resulted in lower land costs.
Operating costs

The data supplied from the two agencies for operating cost estimates appeared in most instances to be based on valid experience and straightforward accounting procedures. The DPR is required to submit operating estimates for a one to two year period covering the portion of the biennium of expected operation. These are attached to each plan when proposed for funding. The only irregularity in appraising these costs for a typical year was in estimating operating costs for vehicles and maintenance equipment. First year budgets included the capital costs for these items as part of operating costs. I was told that in subsequent years they were typically budgeted at about one-fifth of the first year figure, indicating an average five-year replacement schedule. Since it was planned to develop comparisons for all plans by averaging first and sixth year estimates the impact of this initial capital cost on operating budgets was considerably lessened. It would be preferable to treat as capital expenditures, the purchase of all equipment used longer than one year, computing appropriate depreciation rates for annual costs. Breakdowns of these equipment estimates were not available. The reported practice was followed for all the state park plans examined thus it was decided to use these estimates as given.

The data supplied by the DNR appeared to have no irregularities. However, it was immediately evident that these costs are not typically analyzed for individual sites for annual budgeting. This is a natural consequence of the manner in which operating and maintenance activities are conducted. Recreation developments managed by the DNR are set in sizeable blocks of land managed for multiple purposes. Further, none of
these developments is of a scale to justify resident personnel. This is consistent with the primitive style of service provided. The supervision and clean-up required are usually handled on an intermittent basis as use levels require. Men assigned these duties are also given other duties in the general area, which contribute to other management functions, e.g. road maintenance, fire patrol or timber sale inspection. In blocks where recreation development and use have become more intensive, summer recreation aids have been employed who devote most of their time to this supervisory and maintenance work. Typically they are assigned several developed sites plus responsibility for observing and assisting off-site visitors. The result of this management system is to make the estimation of operating costs for a new site a difficult task.

The figures used in this study resulted from detailed discussions with planners covering each site individually and visualizing the probable proportion of supply and personnel costs allocated among the sites assigned to particular men. This allocation was determined only after an examination of the likely levels and patterns of attendance at each of the several sites. This detailed examination of the several components of operating cost was felt to provide reasonably good estimates on a site by site basis.

The largest component of operating cost was for personnel salaries, about 50% for the DPR and 35-40% for the DNR. Equipment budgets were second in rank for each agency. Services (contract) and supplies covered the remaining 20-30% and were most directly related to levels of use. In only a few state parks was a need envisioned to increase personnel or
equipment budgets appreciably due to expected six-year increases in attendance.

**Capacity and use rates**

In assembling data on capacity some definitional decisions were required. Campground capacity was easily determined for state parks since special provisions are required for accommodating campers and their equipment. Separate areas are designated, apart from day use developments. The only question arose regarding the policy of accommodating overflow visitors. These conditions develop on summer holiday week ends. It is practice in Washington state parks to permit late arriving campers (after 9 p.m.) to use day use areas with the understanding that they will leave by 9 a.m. the following morning. Since this represents emergency conditions, no account was taken of this kind of capacity in estimating total design capacity for camping at state parks.

Determining camping capacity of forest campgrounds (DNR) posed no problems since the number of standard units are specified in plans, as for state parks. Doubling up on crowded week ends is known to occur and occasionally by groups of families traveling together, since there is no policy governing number of cars per site. The capacity of one camping unit was assumed to provide service to single car groups.

The determination of capacity for day use has been discussed in a previous chapter. State park planners agreed that parking space for day use was the best criterion for judging this capacity. However, policies regarding overuse are much less clear here. Planners prefer to err on the liberal side in designing day use parking and hope that other
facilities can withstand the infrequent times when overuse occurs. Since day use capacity is defined in terms of persons, based on parking spaces, a conversion variable of persons per car is required. No past records were available from either agency to provide an estimate of average persons per car. The user survey conducted in 1964 for the DPR secured estimates of party size but no record of the average number of cars per interviewed party (3). Party size is reported as 5.2 persons for all interviews and 5.4 persons for Washington residents. However, 11% of the interviews included parties of 9 or more persons which seems to indicate a fair number of multicar groups. The average party size for those with eight or fewer persons is 4.25 persons per party (3, p. D-2). An estimate of 5 persons per car for day visitors was used for all plans.

In approaching the estimate of attendance, most planners agreed that use as a fraction of capacity was the easiest to estimate. Figures for Washington state park use daily by seasons have been assembled in recent years. For camping use these figures are converted to camper days per site per season (or year). The DPR planners define "full" use as 252 camper nights per year. They assume campers to average four persons per group (also per car), which defines full use as 62 days per year.

With this experience and by reference to recent use rates for parks with attributes similar to those of plans being studied, planners provided me with estimates of campers attendance in terms of fractions of capacity for portions of the expected season of use. These were converted to season-long use rates for defined capacity.

A similar process was used to estimate attendance for day use, once rated capacity had been defined. Following estimates of use rates the
resulting number of predicted visitors was compared with attendance at similar parks for 1968 and 1969 as a check on reasonableness. Particular characteristics of location, access and seasons when special attractions might affect attendance (e.g. swimming, clamming, fishing) were then appraised and adjustments made to account for those special attributes.

It became apparent that state park planners had given considerable study to trends in use rates in their respective regions. They were well aware of differences among parks in patterns of use, types of clientele and special seasons of heavy use. The partitioning of the year into special periods, e.g. week ends, week days, summer, hunting and early fishing seasons, appealed to these planners as a means of estimating use in terms of capacity. In arriving at estimates for individual park proposals, entered for peak days versus non-peak days, the recorded rates were built up from calculations for smaller groups of days.

Estimates of use also involved estimating the turnover rate for day users. Heaviest day use is known to occur on most parks between about 11 a.m. and 5 p.m. The pattern, of course, varies greatly with seasons, weather, activities offered as well as with portion of the week. The largest variation is attributed to differences in activity attractions. For example, there may be rather rapid turnover at picnic tables, especially during crowded week ends. On the other hand, swimming and boating usually involve longer periods and less turnover. Fishing and related boating usually show two separate periods, morning and late afternoon. All of these factors and the probable relative numbers of visitors
were considered in each plan in estimating both use rates and turnover rate.

**Length of season**

No difficulty was encountered in estimating season length for either agency. Some of the parks in Region 7 are closed to use during winter months, whereas Region 5 parks stay open all year. Some of the DNR developments are inaccessible during part of the winter. In these cases the effective periods of inaccessibility were subtracted from 365 days to provide estimates for season length.

**Source of clientele**

During the process of estimating use rates it was necessary to be aware of two key factors: (1) the relative nearness of large population areas and (2) likely competitive recreation areas. No attempt was made to recognize these factors explicitly or in any quantitative manner. Rather, reliance was placed on the experience of planners to be able to recognize the importance of these factors in judging the attractiveness of proposed new developments. Given more time and better tools for predicting use, such as have been proposed by Dyer and Whaley (12), and especially by Wennergren and Nielsen (53), it would be possible to refine these estimates considerably.

As we approached the problem of estimating the relative contribution of various market areas to total attendance, these two factors were discussed in detail. For each site, the major market areas were identified and estimates made by comparison with patterns established at similar developed sites, at similar distances from major population centers.
Actually travel time was also given some weight in making these judgments by reviewing the probable travel routes of visitors. The chief weakness of this approach was the lack of specific records of visitor origin during any recent period. Observational experience and reports of park superintendents provided the only available guides. This weakness prompted us to include, as one output from the program, the average travel distance for campers and for day visitors.

**Interest rate**

A number of variables required by the model were either not related to particular sites or could not be estimated by planners. This forced reliance on other data sources for reasonable estimates.

Several of the costs require discount treatment to achieve a common time base. The choice of rate is a critical one for calculating annual costs for all permanent investments. For obvious reasons the rate chosen should be the same for all plans being compared at a given time.

It was assumed for all plans compared in this study that the appropriate rate would be that at which general obligation bonds are currently being sold to finance recreation developments. Interest rates have undergone a rapid rise during 1968-69. In late 1969 bond sales by the state have been made in excess of 6%. For initial evaluations, the interest rate was set at 6%.

**Vehicle cost per mile, campers**

In choosing a value for vehicle cost we were guided by several factors. The current reimbursement rate for use of private cars by persons on official state business is seven cents per mile in Washington.
This rate is, of course, intended to cover fixed costs of ownership as well as variable trip costs. With this rate as a starting point, the added factors which would tend to make camping travel more expensive were examined.

The minimum equipped family on a camping trip must carry a tent and other equipment or use a specially equipped recreation vehicle. Recent reports by the DPR indicate that less than half of their campers now use tents. In 1964-65 the user study indicated 66% using tents but 36% of these (24% of the total) said they planned to purchase either a trailer or pick-up camper (3, pp. ON-2 and ON-4). The trend toward more expensive equipment appears to be continuing.

An informal survey by the author, of acquaintances owning either camper pick-up or trailer revealed that vehicle operating costs on camping trips runs at least 1/3 higher than for normal car travel. Fixed costs of owning these special vehicles was not estimated and no research is known which might provide an estimate of these costs on a visitor day or miles travelled basis.

Considering these factors a choice was made of ten cents per mile for camper travel cost.

**Persons per occupied unit and per car**

Planners had no recorded data on either of these variables. State park planners have a rule of thumb of four persons per car for all visitors. With the one car per site rule now strictly enforced, persons per car and per site will be identical. The DNR administrators have not attempted sample investigations of either variable. Again we were forced
to rely on other studies to estimate these values. A study of water users in Nevada found an average of 4.5 persons per car (17). The DPR user study reported for all campers an average of 4.67 per group. However, this appears to include some multicar groups. For Washington residents the average was 4.8 persons per group (3, p. ON-2).

For camping persons per occupied unit and per car we assumed 4.67 persons at state parks and 4 persons at the DNR campsites. The reason for choosing the lower figure for the DNR was that much use of these areas occurs during fishing and hunting seasons. Groups visiting primarily for these activities are known to be smaller than the usual full family on a summer camping trip, probably averaging between 2 and 3.

For day visits an average of five persons per car was assumed for all but one site, where boating and fishing activities are major attractions. Boating and fishing visitors are assumed to average 2.5 persons per car and thus reduce the average according to their fraction of total attendance during boating and fishing seasons.

Length of stay

We have previously discussed length of stay for day visitors and the lack of good information from studies of various attractions. Our initial assumption is that a day visit averages one-half visitor day.

Length of stay (LOS) for campers is a critical variable for prorating the cost of visitor access per visitor day. We have again relied on the Anschell study for guidance on this estimate since no recent experience was available from planners. For all visitors sampled at the 19 state parks in 1964-65 the average length of stay was approximately
3.4 nights (3, p. ON-8).\textsuperscript{1/} No study has been made of visitors to DNR sites. For purposes of initial analysis we have assumed the same LOS, 3.4 days, for these sites. We suspect this is an overestimate since in general there are fewer activities and attractions at or near these sites.

\textbf{Vehicle cost per mile, day visitors}

Consistent with the approach taken in estimating camper travel cost, we have used seven cents (\$0.07) per mile for day visitor travel cost. This disregards the high travel costs incurred by pick-up campers on day visits. No studies are known to be available on these average costs.

\textbf{Summary}

In summary the data used for testing the model fall into three categories. The most reliable estimates are those dealing with costs for construction and operation of developments, capacity and season length. In the second category are estimates based on the experienced judgement of planners and included attendance rates, clientele areas and land values. The third category includes those variables for which planners have only general knowledge, but which could be rather easily established by studies of existing developments. These include persons per car and per site, length of stay, travel cost per mile and turnover rate. Values for these variables were chosen by reference to applicable studies.

\textsuperscript{1/} Due to the way in which LOS was reported, only an approximate average could be calculated. Quite possibly the average LOS was longer.
Programming the Efficiency Model

In preparing for collecting the data for this study forms were developed detailing the several cost elements, attendance estimates and other data supplied by state personnel. Consolidation of these data together with the other estimates required by the model was accomplished by use of form 4 below. This form was developed directly from the operational version of equation 5.1b, shown below:

\[ D = \frac{V_0 (1 + p)^g (p) + a (1 + p)^g}{(G + H/2)} \]

\[ + \frac{(1 + p)^g (p) \sum E_k}{(G + H/2)} \]

\[ + \frac{(1 + p)^g (p) \sum E_f (1 + p)^f - 1}{(G + H/2)} \]

\[ + \frac{\sum C_4}{(G + H/2)} \]

\[ + \frac{a}{(G + H/2)} \]

\[ + \frac{?KUXZ \sum \left[ \frac{(Y)}{q} \left( \frac{M}{(LP)} \right) \right]}{(G + H/2)} \]

\[ + \frac{2K_1 \left[ R_{w1} + (Z - R)w_2 \right] X_1 T/P_1 \sum (M_1 I_1 S)}{(G + H/2)} \]

For identification of variables see form number 4-1,2,3. All letter symbols were required in upper case for programming. Lower case symbols in the equation are shown in parenthesis on form number 4.
Form No. 4-1  
Site Name  

Region: 6  
Project 1914  
*Year of Operation--calendar yr. 12 13 14  
Agency: 8  
Plan No. 15  

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<th>Hi</th>
<th>Increment</th>
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Explanations: *In box 12 put "1" for first year, "6" for sixth year, etc. In boxes 13, 14 put "69" if first operating year is 1969, etc.
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Explanations:

*In box 12 put "1" for first year, "6" for sixth year, etc. In boxes 13, 14 put "69" if first operating year is 1969, etc.*
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Explanations: *In box 12 put: "1" for first year, "6" for sixth year, etc. In boxes 13, 14 put "69" if first operating year is 1969, etc.
The data entered on form 4 represent a single year for which calculation of costs per visitor day are desired. The variables are arranged in the order in which they appear in equation 5.1c. Each completed form 4 provides data for a deck of 41 IBM cards. Entries are coded in columns corresponding to the numbered boxed on the form. All cards of a given deck are punched with the entries in columns 1-15.

The input data

For each of the variables four figures were entered in columns 21-60. Columns 21-30 lists the estimates received from state planners or assumed as explained above. Columns 19-20 are used to record the years of life expectancy of developed structures. Columns 31-60 are used to record the lower and upper limits and increments of a range over which the estimated values can be varied. (Although these data were recorded for each plan, another method of prescribing range limits was used as explained below in Chapter VIII.)

The entries for cards 27-36 record the data for market areas for campers permitting up to ten such areas to be identified. Columns 21-30 record the highway miles from market center to the site. Columns 31-40 record the decimal fraction of total camper days from each of these zones. Cards 27-42 record similar data for day visitors from up to five market areas.

The output values

The principal output value is cost per visitor day for all costs. This is the proposed criterion for comparing the efficiency of a number of competitive plans. In examining the relative costs of recreation
service interest and concern by decision makers will likely focus on certain cost elements apart from others. It was for this reason that equation 5.1c was written for programming in five separate terms.

In order to recognize this concern with particular elements of cost of service, the program was written to produce a variety of output values. For each output value listed, calculations were made for the first and sixth year of expected operation and the average was computed. This average value was reported for the following individual and combined costs per visitor day:

- $D_1$, total of all costs
- $D_2$, land costs
- $D_3$, indefinite life developments
- $D_4$, finite life developments
- $D_5$, annual operating costs
- $D_6$, visitor access costs
- $D_7$, camper access cost per camper day
- $D_8$, day visitor access cost per visitor day
  (Note: one day visit = 1/2 visitor day)
- $D_9$, all permanent investments ($D_2 + D_3$)
- $D_{10}$, land plus all improvements ($D_2 + D_3 + D_4$)
- $D_{11}$, all construction ($D_3 + D_4$)
- $D_{12}$, all state costs ($D_2 + D_3 + D_4 + D_5$)
- $D_{13}$, all development and operating costs ($D_3 + D_4 + D_5$)
- $D_{14}$, operating plus access costs ($D_5 + D_6$)

Other combinations of the five basic costs could be calculated rapidly
as desired for any specific comparisons. Discussion of comparisons using particular output values will be expanded in a later section.

In addition to the above 14 \( D_1 \) values, the model was programmed to report the weighted average one-way travel distance for campers and for day visitors. Simulated variations for these two averages were also programmed to evaluate the effect of changed assumptions regarding sources of clientele on visitor access costs. (See Appendix for all programs referred to in the text.)
CHAPTER VII. EMPIRICAL TESTS OF THE SYSTEM

This chapter presents the test applications of the system to the 22 selected plans. Sites and plans will be described and the quality, efficiency and overall ratings presented. A number of comparisons will be provided and the uses and merits of each discussed.

The Sample of Plans

For the purposes of testing the selection system, twelve sites were selected, equally divided between the two agencies providing the major supply of recreation service by the state. The division of the plans between the east and west portions of the state provided a good cross section of the variety of attractions and kinds of development offered by these agencies.

Most of the plans included developments for both day use and camping. Two of the initial plans for new state parks included day use service only, while one plan was for expansion of camping service at an existing park. All forest camps are used for both day use and camping, with all units serving either class of visitor. This feature created problems in defining capacity for the separate classes, as discussed above.

For the twelve sites a total of 22 plans were examined. For eighteen of these, estimates of attendance and operating cost were made for the first and sixth operating years. The other four plans involved sites for which current costs and use rates were considered adequate guides for estimating these variables for the expanded developments proposed. Thus a total of 40 data sets were developed for testing the model. Six
plans were compared in each region and area type except in region 7 where four state park plans were examined.

Site Descriptions

State parks, region 5

The three park sites in this region are recently acquired and undeveloped at this time. Two are located on salt water frontage of Puget Sound, the third on a large new power reservoir. All are expected to provide the kinds of recreation attractions now most heavily overused in this and adjoining regions.

Jones Beach. This property consists of 105 acres of wooded water front on the east shore of Puget Sound. A frontage of 1600 feet of sand beach offers an ideal possibility for developing day and overnight service around the major activities of swimming and beach use. It is located between Tacoma and Olympia, 21 miles from the first and 10 miles from the latter. The Seattle metropolitan area is also expected to provide a large source of clientele, located 53 miles from the park. The site is approximately 5 miles from the nearest exit of the major north-south interstate highway, providing still another source of visitors from outside the immediate region. Initial plans include accommodations for day users only. The master plan includes 100 units for campers, using all the remaining area suitable for camping development on presently owned land.

Mayfield Lake. The 228 acre property on this reservoir was acquired by lease from the city of Tacoma (70%) and by purchase of several adjoining tracts. It includes nearly 3 miles of water front near the
upper end of the lake created by the dam built for the city of Tacoma. It is located in the southwestern part of the state close to one of the major east-west highways, and 23 miles from the main north-south interstate highway. Major metropolitan areas of Portland and Seattle are just over 100 miles distant. In this region of the state the only site with similar attractions is heavily overused. Major activities planned for the park include fresh water swimming, fishing and boating. Plans include sizeable developments for both day use and overnight accommodations with facilities for beach and boating activities.

The Wolfe property. This is a 130 acre wooded property on Hood Canal, an arm of Puget Sound, and is endowed with outstanding sand beach frontage. It is located approximately 32 miles from downtown Seattle and about 60 miles from Tacoma and Olympia. The property is connected by one mile of county road to a state highway and bridge crossing Hood Canal. The attractions are salt water beach with possibilities for swimming development as well as boating, plus an outstanding view of shipping and distant shores. Plans call for the development of both day use and overnight facilities with beach front and swimming activities. Clientele are expected to be heavily from the Seattle and outlying metropolitan area. The major deterrent to rapid full utilization of this property is the access cost for many visitors. Visitors coming from the east side of Puget Sound must cross by ferry and toll bridge, requiring considerable added vehicle cost. Population centers lying west of the park are relatively small and will contribute only moderate visitation to this park. Several other parks located west of Puget Sound are now receiving very
heavy use, particularly those serving visitors on extended trips around the Olympic Peninsula. Transient visitors are expected to provide at least 25% of the overnight use of this park.

**State parks, region 7**

The three park sites chosen in this region are all on lake frontage. Two are partly developed at this time and the plans studied provide for expansion of service. The third site has secured initial access developments but has no service features at this time. This last site resembles very closely one of the most popular state parks in the present system about 30 miles away. When developed it will offer many of the same attractions as this nearby park.

**Wenatchee Lake State Park.** This is a presently operating state park experiencing overuse by day visitors and frequently turns away would-be campers. The one plan considered in this study consists of a proposed addition to camping capacity. This site is located at the south end of a very attractive inland lake in a setting of high mountains. The area is served by a state highway approximately 6 miles from one of the main east-west travel routes crossing the Cascade Mountains. The proposed addition will make use of an area of about 105 acres adjacent to the present development. Activities provided in addition to camping will be primarily water front oriented. Swimming, boating and fishing are all included. The primary clientele areas for campers are the Seattle metropolitan area with modest numbers coming from the eastern portion of the state. Seattle populations are located approximately 100 miles distant. Because of the elevation and the winter season, this park is open only 153 days per year.
However, as winter camping increases in popularity, the open season may be lengthened.

**Pearrygin Lake State Park.** This park is located on a small inland lake in the north central portion of the state. The total property is 578 acres, of which 478 acres have been identified for this development. This area is at moderate elevations and in a dry, warm climate. Trees are sparse on the area and confined to the water margin. Present use is almost entirely by day visitors. Attractions consist of bathing and fishing with moderate power boat activities. The plans examined in this study consist of added camping facilities to accommodate overnight visitors. This addition requires an updating of other service facilities to accommodate the increased numbers. The park is located at considerable distance from any sizeable metropolitan areas. Consequently, access costs to this park are much higher than for the other plans examined. Part of the reason for expansion plans at this park are because of increasing recreational interest in the general area and expected opening of the new North Cross State Highway in the near future. This highway and the development of the new North Cascades National Park is expected to bring a rapid increase in demands for recreation service. Clientele will be largely from metropolitan areas on the west side of the Cascades plus a fair number of out-of-state visitors.

**Steamboat Rock State Park.** This 1500 acre property has been turned over to the State Park Department by the U.S. Bureau of Reclamation. It is located on Banks Lake reservoir, a holding basin for irrigation water used in the Columbia Basin Reclamation Project. The site is
located in a very dry, hot summer climate with moderate temperatures during the cold months. This large body of water has been stocked with game fish and has become an increasing focal point for fishermen. Development plans for this site will include boating and swimming facilities. Initial plans call for development of day use facilities only. While some overnight use may occur, this will be closely controlled by supervisory personnel. This area will provide an alternate location for visitors turned away at nearby Sun Lakes State Park. This fully developed park operates at capacity during much of the warm weather season and many visitors are turned away. Because of its climatic attraction, plus the activities available, this park is popular with Seattle and vicinity people. Steamboat Rock is located approximately 150 miles from downtown Seattle. Day use visitors are expected to come mostly from transient vacationers on route elsewhere. The nearest sizeable cities are approximately 85 miles distant.

Forest camps, region 5

Of the three sites chosen for study in this region, administered by the Department of Natural Resources, two are small camps or picnic grounds currently in use. The third represents a complex of developed sites located on the Capitol Forest property near Olympia. Recreation on this Capitol Forest is viewed as a progressive development for the entire property. We chose the entire complex as a unit for this study. Capitol Forest sites are located on either small streams or at higher elevations, commanding a view of the surrounding country. The other two sites are located on water, one on a medium sized river, the other on a small lake.
Camp Spillman. This 10 acre property lies on the Kitsap Peninsula which extends northward into Puget Sound, directly west from Seattle and adjoining cities. The site lies on both sides of a small river providing a pleasant setting and a source of fishing activity. Plans studied for this site include the present level of development and an expanded development for a comparison. Clientele for this site come primarily from the surrounding urban areas, particularly Bremerton and Tacoma. This site receives a modest visitation from Seattle and adjoining cities. These latter visitors would normally use a ferry to cross Puget Sound.

Paul Sharp Scenic Picnic Area. This partly developed site consists of 15 acres on a bluff overlooking the east shore of Hood Canal and with frontage on a small inland lake. Its chief attractions are the views to the west of the Olympia Mountains and Hood Canal plus the fishing opportunities in the lake. A boy scout camp is located about 1 mile distant at the opposite end of the lake. This site is about 12 miles more distant from the same urban areas as is Camp Spillman. The proportions of clientele from these areas and from the Seattle area are similar. The minimum present development plus difficult access has kept attendance relatively low to date. Development plans call for improving the access road, more complete signing for directing potential visitors plus added facilities to accommodate them. The primary activities to be developed here are fishing, viewing the spectacular sights and nature walks.

Capitol Forest. This study unit departs from the usual pattern in embracing approximately 80,000 acres of land in a solid block, mostly state owned. It is managed as a multiple use unit for timber and
recreation. Its location close to the capital city of Olympia plus its striking relief and cover features have provided the opportunity for a complex of developed sites embracing a variety of improvements and facilities. Eight individual sites have been identified for development and three of these are presently accommodating visitors. In addition, considerable work has been done to improve the roads for recreation use, develop hiking and riding trails, and to add interpretive sites for the education of visitors. A number of historic features are known to exist on the area and these are also planned for development and interpretation. Since recreation has been included as a major purpose of management of this heavily timbered property, some modification of timber management practices has been employed to enhance recreation values. Clientele for this area comes principally from the Olympia and nearby Tacoma metropolitan areas. Since a modest amount of visitation does not involve use of individual sites, the concept of site capacity is difficult to apply. However, the overall concepts of investment and operating efficiency as well as quality have applicability to this unit.

Forest camps, region 7

The three sites chosen in this region all lie near the northern border of central Washington, just west of the Okanogan Valley. All three are located on natural lakes and provide similar activities and attractions.

Leader Lake. The site is located on a small natural lake which is being controlled by a dam at the outlet in order to supply irrigation water to a local district. State ownership of approximately 3/8 of a mile of frontage is being used with minimum development by nearby residents.
The site is located 9 miles from the town of Okanogan, 14 miles from Omak. These two towns provide the bulk of the clientele for this site. Attractions at this lake are fishing and viewing wildlife. Some walking for pleasure is done with no specific developments for this activity. Plans include securing control of water levels by negotiation with the water rights owners, and shoreline development for camping and day use development. It is expected that this site will receive much increased use with the opening of the North Cross State Highway in about 3 years. This general area of the state is receiving increased use from out of the region visitors each year.

**Palmer Lake.** This site is located on a narrow strip of land lying between the state highway and a lake front. Opportunities for development are quite restricted due to the narrowness of this strip and the one quarter mile of frontage. Chief attractions are the very scenic views plus the pleasant setting for overnight and day use. Present developments are limited to a few picnic tables and restrooms. A boat launching area provides access for fishermen and other boaters to the lake. Plans call for expanded developments of camping and day use facilities. Added activities to be considered are trail riding and hiking. Clientele are made up chiefly of a modest number of local users plus transient visitors en route to and from Canada.

**Chopaka Lake.** This site is located in a relatively open setting on the shore of a beautiful lake situated at about 4,000 feet elevation. The lake is managed by the Game Department for trout fishing with artificial flies only. Access to this site is approximately 6 miles of steep
grade on a forest road from the nearest state hard surface road. There are no sizeable population centers closer than 100 miles. Attractions and activities at this site include fishing, canoeing, hiking and hunting. Because of the access features and the limited nature of activities, this site is not expected to attract large numbers of visitors. Visitation, however, is expected to be moderate for at least 200 days per year. For the purpose of this study, the present development was analyzed as the initial level with land purchase and further development to a higher capacity to provide a comparison.

The Quality Ratings

The procedure for rating the quality of proposed plans has been discussed in Chapter IV. Ratings were made by the planners who had provided the other data. Figure 2 (shown in Chapter IV) was used to provide scores for the two aspects of quality which were combined to produce the raw quality score.

The weighted quality score as prepared for reporting on form 5.1 is computed as follows:

\[ Q^* = Q \sum q_i \]  

(4.2)

where

- \( Q^* \) = Quality score
- \( Q \) = assigned weight \( 0 < Q < 1 \)
- \( q_i \) = individual facets of quality

It will be recalled that the total score for a given plan results from combining the quality and efficiency scores:

\[ S = Q^* + E^* \]  

(4.1)

where \( S \) = overall score
E* = efficiency score

The two elements, quality and efficiency, are weighted by policy decision such that the combined weights total one.

Thus \( E + Q = 1 \)

For the tests of the system in this study these weights were set at 0.5 for each element.

The Efficiency Scores

The efficiency score is calculated by comparing the cost per visitor day for a given plan to a base value or norm \( (D^*) \) which may be derived in several ways as discussed in Chapter V. For the purposes of this study the minimum values for each of the five cost elements found among the 10 plans were combined to provide a \( D^* \) value for state park plans. A similar combination of minimum element values provided the \( D^* \) value for all 12 forest camp plans. These were used in the calculation of efficiency scores as follows:

\[
E^* = E \left( \frac{D^*}{D} \right) \times 100 \tag{4.3}
\]

where

\( E^* \) = the efficiency score
\( E \) = the assigned weight (0.5 for this study)
\( D^* \) = the base cost per visitor day
\( D \) = cost per visitor day of given plan

Comparative Evaluations

The comparative evaluations of plans are reported in four groups, one for each region and area type, on tables 3-6 below. Items 1-3 indicate the make-up of the overall scores. Items 4 - 5 are needed to gauge the impact of particular selections on given budgets. Items 6 - 7 show the
total extent of state resources being allocated for capital investment. Items 8 - 10 provide measures of capacity being planned, and expected use during the first and sixth years. Item 11 provides estimates for total cost per visitor day and for each element of cost. Item 12 records the base cost or norm, D*, to be used in calculating the efficiency rating, E*.

Region 5 state parks

Quality comparisons. Quality comparisons of these six plans are interesting for two reasons (see table 3). First, master plans in each case show a slight gain over initial plans for quality of design. This is to be expected when designers themselves do the rating, as in this case. Second, the rank ordering of sites is the reverse of that for overall and efficiency scores. Even though quality is weighted equally with efficiency in this application, the discrimination on efficiency grounds is greater here than on quality. The spread of quality scores from poorest to best is only about 4.5 points, for efficiency it is more than 26 points, sufficient to overpower the reverse ordering on quality grounds.

Efficiency comparisons. Efficiency comparisons can be readily made using line 3 of table 7. Line 11 provides direct comparisons of total costs per visitor day. Further comparison of individual cost elements can be made on lines 11a through 11f. These comparisons can be seen graphically by referring to figure 9.

It will be noted that the major cost reduction achieved by master plans over alternate initial levels of development is due to lower land
Table 3  Comparative evaluation of development proposals for state parks, region 5.

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<th>Site Name</th>
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<td>Rank No.</td>
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1. Overall score \( S = Q^* + E^* \)^a
   - Jones Beach Master: 81.95
   - Jones Beach Initial: 75.45

2. Quality score \( Q^* \)^a
   a) Site quality score
   - Jones Beach Master: 32.6
   - Jones Beach Initial: 32.6
   b) Design quality score
   - Jones Beach Master: 42.5
   - Jones Beach Initial: 40.3

3. Efficiency score \( E^* \)^a
   - Jones Beach Master: 44.4
   - Jones Beach Initial: 39.0

4. Years from funding to service
   - Jones Beach Master: 1
   - Jones Beach Initial: 1

5. Acquis. & devel. $, this budget
   a) Total devel. cost, $
   - Jones Beach Master: 528,167
   - Jones Beach Initial: 298,689
   b) Land acquis. cost, $
   - Jones Beach Master: 0
   - Jones Beach Initial: 0

6. Total land value, $
   - Jones Beach Master: 391,128
   - Jones Beach Initial: 391,128

7. Total development value, $
   - Jones Beach Master: 617,392
   - Jones Beach Initial: 353,492

8. Capacity (PAOT)^b:
   a) Camping
   - Jones Beach Master: 467
   - Jones Beach Initial: 0
   b) Day use
   - Jones Beach Master: 1,000
   - Jones Beach Initial: 750

9. Attendance (V-D)^c 1st service year:
   a) Camping total
   - Jones Beach Master: 18,297
   - Jones Beach Initial: 0
   b) Camping, per unit/year
   - Jones Beach Master: 183
   - Jones Beach Initial: 0
   c) Day use, total\(d\)
   - Jones Beach Master: 88,350
   - Jones Beach Initial: 66,262
   d) Day use, per unit/year
   - Jones Beach Master: 441
   - Jones Beach Initial: 441

10. Attendance (V-D)^c 6th service year:
    a) Camping, total
    - Jones Beach Master: 31,705
    - Jones Beach Initial: 0
    b) Camping, per unit/year
    - Jones Beach Master: 317
    - Jones Beach Initial: 0
    c) Day use, total\(d\)
    - Jones Beach Master: 147,730
    - Jones Beach Initial: 80,550
    d) Day use, per unit/year
    - Jones Beach Master: 738
    - Jones Beach Initial: 537

11. Average costs/V-D, 1st + 6th yrs.; total, $
    a) Land use, cost/V-D, $
    - Jones Beach Master: .19
    - Jones Beach Initial: .34
    b) Developments, total, cost/V-D, $
    - Jones Beach Master: .34
    - Jones Beach Initial: .36
    c) Operation & maintenance, cost/V-D, $
    - Jones Beach Master: .51
    - Jones Beach Initial: .51
    d) Access, cost/V-D, all visitors, $
    - Jones Beach Master: 1.55
    - Jones Beach Initial: 1.74
    e) Access, cost/V-D, day visitors, $
    - Jones Beach Master: 1.74
    - Jones Beach Initial: 1.74
    f) Access, cost/V-D, campers, $
    - Jones Beach Master: .70
    - Jones Beach Initial: 0

12. Base cost/V-D, (D\(x\)), $
    - Jones Beach Master: 2.30
    - Jones Beach Initial: 2.30

\( ^a \) Efficiency and quality are each weighted 50% in overall score, $S\\n\( ^b \) PAOT = persons at one time\\n\( ^c \) V-D = visitor days\\n\( ^d \) Two day visits equals one visitor day
region 5.

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Fig. 9 Costs per visitor day for 6 state parks, Region 5
costs. This is a direct consequence of prorating the fixed land value over the greater number of visitor days of service provided. For similar reasons development costs per visitor day are consistently higher in most initial plans than for master plans. This occurs because some development inputs are "lumpy" by nature, permitting only one size of investment. Examples are access roads, administration buildings and beach developments which use all available frontage. For example, the two plans for Mayfield Lake include several items which must be accomplished regardless of the capacity to be provided. Among these are site preparation, the main access road, water and electric systems and a minimum area of irrigation. As capacity and attendance are doubled in this case in expanding from initial to master plan the cost of land is approximately halved, that for developments is reduced by about 25%. Scale economies are evident for development costs in all comparisons between initial levels and master plans for the state parks studied.

The most obvious differences among the three sites are due to access costs for visitors. The Jones Beach site, a preferred choice at either level of development, has the most favored location in relation to population concentrations (see Appendix). The average travel distance is approximately 55 miles for campers and 31 miles for day visitors. For Mayfield Lake these distances are 89 and 63 miles, respectively. The Wolfe Property would be a fair competitor for the Mayfield Lake site, were it not for very high access costs. Even though this site is located a distance from Seattle similar to Jones Beach (54 and 36 miles average travel for the two classes), most visitors are required to add ferry and bridge tolls to their mileage costs. This forces the access element of
cost to nearly 2.5 times that for Jones Beach and about twice that for Mayfield Lake.

The pattern of operating costs for the six plans shows no clear trend with size of development (in capacity terms). However, when size and use rates are combined there is a clue that these factors may account for the higher costs per visitor day for the Wolfe property. There are certain minimum levels of staffing for any state park, usually involving a superintendent and assistant plus one or more laborers. Swimming requires one or several life guards on a seasonal basis. With the relatively small size of both camping and day use facilities in the Wolfe plans plus the consistently lower use rate for camping, operating costs are notably higher per visitor day than for the other two sites.

Region 7 state parks

Quality comparisons. Of the three sites and four plans compared in this region, one site, Wenatchee Lake, stands out in quality terms. This site is the only one to offer climatic relief in summer, ample tree cover and outstanding lake scenery. Quality of design rates high for two main reasons. Plans include development of two standard, tested camp loop designs with attendant facilities, plus access roads and a foot bridge. The ease with which these developments can be fitted to the gently sloping land will produce a high quality development. The other three plans are close together in quality scores. The initial plan for Steamboat Rock is scored lowest because of design deficiencies. This plan admittedly is for only partial development (day use only). Some features essential to full service were sacrificed to stay within initial
funding limits.

**Efficiency comparisons.** Only one scale comparison is provided by park plans in this region. The differences in the two plans for Steamboat Rock show trends similar to the comparisons for region 5 parks (see table 4 and figure 10). Land development and operating costs all show gains for the master over the initial plan. The reversal of access costs is due to the location of this site relative to population centers. Day use access cost remains constant for the two levels, however the addition of camping facilities, with attendant higher access costs at the master plan level produces a higher average cost for all visitor access. Operating cost comparisons show gains for the master plan for Steamboat Rock. Both capacity and use rate are highest among the four plans. Season length is shortest for Wenatchee Lake, longest for Steamboat Rock. The combined high capacity and highest use rates at Steamboat Rock account for the considerable gain in operating cost.

**Region 5 forest camps**

**Quality comparisons.** The relation of quality scores to overall scores for this group of plans shows no consistent pattern (see table 5). For example, the plan with the highest overall score stands fourth for quality, seven points below the best. The same site, now developed at the initial level could well lose patronage if the competing site (Paul Sharp) were developed to master plan level since it ranks higher both overall and in quality terms (second place). This in turn might result in reducing the efficiency of the Spillman site, through reduced use rates. Until we know more precisely how quality of new sites affects
Table 4 Comparative evaluation of development proposals for state park plans, reg

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<th>Site Name</th>
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<th>Pearlygi</th>
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</table>
1. Overall score \(S = Q^* + E^*)^a  | 81.4 | 77.1 |
2. Quality score \(Q^*)^a   | 46.5 | 40.5 |
   a) Site quality score  | 43.0 | 38.0 |
   b) Design quality score | 50.0 | 43.0 |
3. Efficiency score \(E^*)^a  | 34.9 | 36.6 |
4. Years from funding to service | 1 | 1 |
5. Acquis. & devel. $, this budget | 462,340 | 365,955 |
   a) Total devel. cost, $ | 271,033 | 365,955 |
   b) Land acquis. cost, $ | 191,307 | 0 |
6. Total land value, $ | 191,307 | 259,290 |
7. Total development value, $ | 311,688 | 420,848 |
8. Capacity (PAOT)^b: |
   a) Camping | 467 | 233 |
   b) Day use | 0 | 1,250 |
9. Attendance (V-D)^c 1st service year: |
   a) Camping total | 24,650 | 18,473 |
   b) Camping, per unit/year | 246.5 | 369 |
   c) Day use, total^d | 0 | 45,938 |
   d) Day use, per unit/year | 0 | 184 |
10. Attendance (V-D)^c 6th service year: |
   a) Camping, total | 39,555 | 22,467 |
   b) Camping, per unit/year | 395.5 | 449 |
   c) Day use, total^d | 0 | 53,440 |
   d) Day use, per unit/year | 0 | 214 |
11. Average costs/V-D, 1st + 6th years; total, $ | 3.30 | 3.14 |
   a) Land use, cost/V-D, $ | .40 | .24 |
   b) Developments, total, cost/V-D, $ | .80 | .46 |
   c) Operation & maintenance, cost/V-D, $ | .69 | .65 |
   d) Visitor access, cost/V-D, all visitors, $ | 1.40 | 1.80 |
   e) Visitor access, cost/V-D, day visitors, $ | 0 | 1.42 |
   f) Visitor access, cost/V-D, campers, $ | 1.40 | 2.71 |
12. Base cost/V-D, (D^*), $ | 2.30 | 2.30 |

^a Efficiency and quality are each weighted 50% in overall score, S

^b PAOT = persons at one time

^c V-D = visitor days

^d Two day visits equals one visitor day
### PROPOSALS

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Each weighted 50% in overall score, $
Fig. 10  Costs per visitor day for 4 state park plans, Region 7
Table 5 Comparative evaluation of development proposals for forest camps, region

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<th>Site Name</th>
<th>Plan</th>
<th>Rank No.</th>
<th>Spillman Master</th>
<th>P. Sharp Master</th>
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1. Overall score \( (S = Q^* + E^*)^a \) 73.37 71.83
2. Quality score \( (Q^*)^a \)
   a) Site quality score 39.75 46.75
   b) Design quality score 31.0 42.0
3. Efficiency Score \( (E^*)^a \) 33.62 25.08
4. Years from funding to service 1 1/2
5. Acquis. & devel. $, this budget 13,984 11,170
   a) Total devel. cost, $ 13,984 11,170
   b) Land acquis. cost, $ 0 0
6. Total land value, $ 3,500 51,500
7. Total development value, $ 16,082 12,945
8. Capacity (PAOT):\(^c\)
   a) Camping 24 24
   b) Day use 40 20
9. Attendance (V-D)\(^d\) 1st service year:
   a) Camping total 3,066 2,650
   b) Camping, per unit/year 511 442
   c) Day use, total\(^e\) 1,873 1,864
   d) Day use, per unit/year 234 466
10. Attendance (V-D)\(^d\) 6th service year:
    a) Camping, total
    b) Camping, per unit/year
    c) Day use, total\(^e\)
    d) Day use, per unit/year
11. Average costs/V-D, first plus sixth years; total, $ 2.35 3.15
    a) Land use, cost/V-D, $ .05 .70
    b) Developments, total, cost/V-D, $ .31 .19
    c) Operation & maintenance, cost/V-D, $ .74 .79
    d) Visitor access, cost/V-D, all visitors, $ 1.26 1.47
    e) Visitor access, cost/V-D, day visitors, $ 2.01 2.44
    f) Visitor access, cost/V-D, campers, $ .79 .80
12. Base cost/V-D, (D*), $ 1.58 1.58

\(^a\) Efficiency and quality are each weighted 50% in overall score, S
\(^b\) Assumed = 0 for this budget, since all land is now in state ownership
\(^c\) PAOT = persons at one time
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\( ^d \) V-D = visitor days

\( ^e \) Two day visits equals one visitor day

\( ^f \) Estimates made for first year only
their appeal and patronage in competition with existing sites, our ability to predict use rates of specific sites will be shaky.

**Efficiency comparisons.** Scale economies for these plans are evident only for land costs for master as opposed to initial plans, see table 5 and figure 11. Development inputs for most of these plans are not as "lumpy" as are those for state parks. There appears to be a point in developing forest camps at which major improvements in water supply, parking space, barriers and signing, sanitation and other items are called for to handle higher levels of use. This is most evident in comparing the two plans for the Paul Sharp picnic ground. Initial plans require no improvement of the minimum road now in place. Facilities are minimal and use rate is low. For the master plan, with nearly 2 1/2 times the capacity, major improvements are required in roads, parking and water supplies. A similar situation occurs at the Spillman site. The results for these comparisons are that development costs per visitor day are essentially unchanged for the two levels. In the case of the Capitol Forest scale economies appear to be negative. Expansion from the initial level involves two groups of costs. One is for added developed sites at costs per unit capacity similar to the initial level. The other group involves a much expanded road and trail system. Since much of the present use is of existing logging roads, this investment in road improvement will enhance this service to sightseers at increased levels of use. The present (initial) trail system is minimal. The master plan prescribes a much expanded system of trails since this activity has proven popular. Thus the comparisons between development levels are not valid comparisons
Fig. 11 Costs per visitor day for 6 forest camp plans, Region 5
of scale. This change in the kind of service rendered is largely responsible for the increased operating cost per visitor day at the master plan level.

Operating cost comparisons for the Paul Sharp site show a startling increase for the master plan. Present use of the initial development is so light that no specific schedule of maintenance and cleanup is used. Occasional visits by personnel are combined with other duties, costs are kept low. With expanded development and use requiring scheduled visits, budgets must be carefully drawn up to provide a consistent level of cleanup and supervision. The addition of camping increases the need for scheduled visits to keep facilities and grounds at acceptable levels of cleanliness and repair. A similar relationship exists for the two plans for the Capitol Forest. More road and trail maintenance as well as costs incurred in caring for more than twice the number of sites raises the cost per visitor day. Maintenance schedules at Camp Spillman call for only modest increases at the master plan level since this area now receives steady use at a fairly high rate. Thus, increased capacity and use will reflect scale economies in reduced operating cost per visitor day.

Differences in access cost between sites are too slight to provide good separation. All of these sites are relatively close to large population centers. Most of the differences between plans are due to shifts in the balance between day and overnight use. Day user access consistently costs 2 1/2 - 3 times that for campers on a visitor day basis in this region.
Region 7, forest camps

Quality comparisons. The six forest camp plans considered in this region show little variation in quality. One site was notably lower in quality of the site itself, due to its small size and location along a state highway. Differences in design quality were minor. It is suspected that this may be due, in part, to securing these ratings from the same men who were responsible for the plans. The author agrees in general with the relative scores assigned by these planners. Details for master plans were not available so no opinion of the design ratings for these plans could be formed.

Efficiency comparisons. Efficiency comparisons for these six plans reveal a much different pattern than was shown by forest camps in region 5. Total cost spread is here reduced to just over one dollar ($3.71-$4.75) per visitor day. For four of the plans separation is provided almost completely by visitor access cost (see table 6 and figure 12). No clear relationship is revealed between master and initial plans such as was found for parks and for region 5 forest camps. The variety of patterns revealed by scale comparisons requires explanation.

The Chopaka Lake plans call for the greatest increase in scale, from initial to master level, of all forest sites examined (see item 8, table 6). In providing this expansion considerable added land is required forcing this element to a higher cost per visitor day. The expanded attractions and capacity are expected to result in extending the clientele area for the unusual activity provided, fly fishing for large trout. This results in higher access costs.
Table 6  Comparative evaluation of development proposals for forest camps, region 7

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Fig. 12 Costs per visitor day for 6 forest camps, Region 7
The Leader Lake site is considerably expanded in the master plan, especially for campers. Efficiency gains are expected for access costs as higher proportions of visitors are drawn from travellers using the cross-state highway for access to the new North Cascades National Park. Their access cost is trivial since they are assumed to be en route elsewhere. State costs total the same at both levels though with increased operating and slightly reduced development costs for the master plan.

The Palmer Lake master plan provides no increased capacity based on picnic and camping units. Added development costs are incurred to expand the attractions to include riding trails and horse facilities. This is expected to produce a higher use rate over a longer season. It will also increase operating costs for the maintenance of trails and other facilities. The only cost reduction at this level results from more intensive use of the fixed land investment.

It is interesting that the DNR plans now being approved (February 1970) call for first attention to expanding the Leader Lake site, presently partly developed. Approval has also been given to enter an exchange agreement to secure the land needed for expanding development of the Chopaka Lake site, now developed at the initial level. In terms of overall scores, this follows the sequence of ranking achieved in this analysis.

Alternate Comparisons of Efficiency

In developing the model for this study, we have argued that all the costs of providing recreation service should be considered in any comparisons leading to choice. We recognize however, that in some situations and
for some purposes, individual cost elements will assume greater importance for comparisons. Furthermore, other systems have been proposed for making efficiency comparisons as discussed in Chapter III. These systems have usually emphasized capital development costs and sometimes operating costs. Therefore, we have intentionally separated the four elements of cost in the analysis and discussion since each may be used as a criterion singly or with one or more of the others.

Tables 7 and 8 provide comparisons for combinations of two or more cost elements which may prove of interest as alternative efficiency comparisons. Column (1) represents the total of capital costs; column (3) sums the two commitments made to develop and operate a given property, previously acquired. Column (5) yields comparisons of all state commitments of resources. Column (7) lists the ranking originally achieved by efficiency comparisons in the full model. Columns (2), (4) and (6) report the rank order under the alternate groups of cost elements.

In examining the comparative rankings of individual plans under alternate cost criteria, some apparent inconsistencies require explanation. In region 5 parks (Table 7) the improved ranking, omitting access cost, of the Wolfe property was anticipated. The consistently poor showing of the initial plan for Mayfield Lake again emphasizes the effect of "lumpy" capital inputs.

In region 7 parks the first position of the Steamboat Rock master plan in column (4) emphasizes the effect of scale economies for both development and operating costs. The high land costs in this plan might be considered irrelevant by decision makers since use of this land is provided at no cost to the state.
Table 7  State park costs per visitor day and ranking within regions under alternative cost criteria.

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<th>Name</th>
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<th>Development + Operating</th>
<th>Land + Development + Operating</th>
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Table 8  Forest camp costs per visitor day and ranking within regions under alternative cost criteria

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<td>.45</td>
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</tr>
<tr>
<td>REGION 7</td>
<td>PLANS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chopaka Lake</td>
<td>Initial</td>
<td>1.31</td>
<td>1</td>
<td>67</td>
<td>4</td>
</tr>
<tr>
<td>Leader Lake</td>
<td>Master</td>
<td>1.35</td>
<td>2</td>
<td>.52</td>
<td>2</td>
</tr>
<tr>
<td>Palmer Lake</td>
<td>Initial</td>
<td>1.37</td>
<td>3</td>
<td>.43</td>
<td>1</td>
</tr>
<tr>
<td>Leader Lake</td>
<td>Initial</td>
<td>1.50</td>
<td>5</td>
<td>.52</td>
<td>3</td>
</tr>
<tr>
<td>Palmer Lake</td>
<td>Master</td>
<td>1.53</td>
<td>6</td>
<td>.98</td>
<td>6</td>
</tr>
<tr>
<td>Chopaka Lake</td>
<td>Master</td>
<td>1.43</td>
<td>4</td>
<td>.70</td>
<td>5</td>
</tr>
</tbody>
</table>
Among forest camps in region 5 (Table 8) columns (3) and (4) provide some rather startling shifts in ranking. The shift for the Paul Sharp site again reflects the effect of very low development and operating cost levels even though use rates are low. Land costs are responsible for the poorer ratings where this cost element is included. The poor showing of the Capitol Forest master plan has been explained in the previous section. These low rankings serve to emphasize that gradual development of this property which keeps pace with slow increases in use is apparently a more efficient choice than immediate development of all planned improvements.

The shifts in ranking for Camp Spillman draw attention to the effect of low cost land. When land costs are excluded, this site is inferior to the Paul Sharp site at either level of development.

It was noted in the previous section that, for region 7 forest camps, access costs show only slight differences for five of the six plans. Table 8 therefore shows only minor shifts in rank with this cost omitted. Land costs are the next in size to access cost. When this cost is also omitted (columns (3) and (4)) the shifts in rank are considerable. For example the Palmer Lake initial plan now ranks first, although total efficiency places it in third rank. When quality is also considered its overall rank drops to fifth. This comparison emphasizes the importance of considering all cost factors in designing a system for choice.

Averages and Ranges for Cost Elements

While this study was not designed to examine a random sample of site plans there is some reason to expect the ones examined to be representative of plans recently funded or planned for early proposal. Assuming
they are reasonably representative it is informative to examine and compare averages and ranges in the cost elements analyzed. Table 9 presents a number of averages for state park and forest camp plans which serve to emphasize some of the trends identified in previous comparisons. Ranges are expressed as a ratio of highest to lowest values recorded. This ratio indicates the relative extremes exhibited by individual or combined cost elements. In addition to total cost and the four basic cost elements, averages are shown for alternate criteria using the groupings of cost elements compared in the previous section.

**State park plans**

Perhaps the most striking finding on this table is that initial plan levels provide service which averages 29% more costly than master plans considering all costs—$4.77 versus $3.71 per visitor day. For all state costs (Column (8)) this increase is nearly 60%. Each of these elements shows gains at the master plan level. Access cost is slightly higher at the master plan level. This should not be surprising since master plans often include fuller development of attractions thus increasing the appeal to more distant visitors.

The inconsistency in access cost between regions 5 and 7 requires explanation. In region 5 one site, the Wolfe property showed access costs nearly twice the average for all sites (approximately $4.00 per visitor day). This is due to the added ferry and bridge tolls incurred by most visitors to this site. However, the other four plans for region 5 averaged $.26 per visitor day higher than the four plans in region 7. Examination of the make up of access costs reveals a much higher average
Table 9  Averages and ratios of highest (H) to lowest (L) for cost elements; all costs are per visitor day.

<table>
<thead>
<tr>
<th>Number of Plans</th>
<th>STATE PARKS Plans</th>
<th>(1) Total Cost</th>
<th>(2) Land Cost</th>
<th>(3) Development Cost</th>
<th>(4) Operating Cost</th>
<th>(5) Access Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Av., $</td>
<td>H/L</td>
<td>Av., $</td>
<td>H/L</td>
<td>Av., $</td>
</tr>
<tr>
<td>6</td>
<td>All region 5</td>
<td>4.25</td>
<td>2.5</td>
<td>.48</td>
<td>5.6</td>
<td>.54</td>
</tr>
<tr>
<td>4</td>
<td>All region 7</td>
<td>4.23</td>
<td>2.1</td>
<td>1.37</td>
<td>15.9</td>
<td>.64</td>
</tr>
<tr>
<td>5</td>
<td>Initial plans</td>
<td>4.77</td>
<td>2.2</td>
<td>1.23</td>
<td>11.0</td>
<td>.67</td>
</tr>
<tr>
<td>5</td>
<td>Master plans</td>
<td>3.71</td>
<td>2.1</td>
<td>.59</td>
<td>5.8</td>
<td>.49</td>
</tr>
<tr>
<td>10</td>
<td>All Park Plans</td>
<td>4.24</td>
<td>2.5</td>
<td>.91</td>
<td>20.2</td>
<td>.58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOREST CAMPS Plans</th>
<th>(1) Total Cost</th>
<th>(2) Land Cost</th>
<th>(3) Development Cost</th>
<th>(4) Operating Cost</th>
<th>(5) Access Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Av., $</td>
<td>H/L</td>
<td>Av., $</td>
<td>H/L</td>
<td>Av., $</td>
</tr>
<tr>
<td>6</td>
<td>All region 5</td>
<td>3.54</td>
<td>1.8</td>
<td>.81</td>
<td>22.8</td>
</tr>
<tr>
<td>6</td>
<td>All region 7</td>
<td>4.36</td>
<td>1.2</td>
<td>1.00</td>
<td>2.5</td>
</tr>
<tr>
<td>6</td>
<td>Initial plans</td>
<td>4.00</td>
<td>1.7</td>
<td>1.05</td>
<td>14.3</td>
</tr>
<tr>
<td>6</td>
<td>Master plans</td>
<td>3.85</td>
<td>2.0</td>
<td>.76</td>
<td>21.0</td>
</tr>
<tr>
<td>12</td>
<td>All Forest Camps</td>
<td>3.92</td>
<td>2.0</td>
<td>.90</td>
<td>46.4</td>
</tr>
</tbody>
</table>
cost for day visits to region 5 parks (see Table 3). Further inspection showed that this, in turn, was due to the low proportion of total day visits from transient highway travellers, less than 15%. On the contrary, region 7 parks were expected to receive more than 30% of their total day use from transients, reducing the average travel distance proportionately. Average day visitor travel distance in the three region 7 plans (Lake Wenatchee is camping only) is about 25 miles. For the six plans in region 5, the weighted average is 40 miles. The two regions show similar proportions of total visitor days in each category. Visitor days for day visitors constitutes 64% of region 5 and 67% of region 7 totals.

The variation encountered for the four cost elements does not appear excessive, except for land costs. We have noted the differences in size and sources of acquisition. One site, valued at over $2,500,000 was acquired at no cost to the state (Steamboat Rock). The plans examined for this site called for development of approximately one-fifth of this property, however the major part of the value is ascribed to the four miles of choice waterfront, with obvious potential for still further expansion. The greatest consistency is shown for master plan operating and development costs.

Forest camp plans. Comparisons of forest camp plans reveal no clear advantage for the larger scale master plans. Initial plans show only $.15 higher total cost and $.07 higher state costs than for master plans. It is interesting to note that development and operating costs are consistently higher for master plans, being more than offset by lower land costs (Column (7) vs. Column (2)). If this trend were verified by
a more complete sampling it could have important policy implications in determining or weighting the criteria for choice.

Comparisons between the two regions raises doubts regarding a number of specific costs. Land costs and development costs do not appear to diverge unreasonably. Operating cost differences invite further investigation. In region 5, with costs four times those for region 7, it has been the practice to assign special personnel, both seasonally and year-long to provide maintenance and supervision for several developed sites. This service has been supplied in region 7 at lower levels of cost by personnel given other assignments for part of their time. These multiple purposes permit more efficient use of personnel to serve the widely scattered developments in this region. Region 7 planners recognize that as plans are expanded, special recreation aids will be employed. However, they are unfamiliar with estimating costs on this basis and appear to have been quite conservative. It seems probable that closer estimates would fall nearer those made by the more experienced planners in region 5.

The differences in access cost between these regions has been discussed earlier. Region 7 is one of the most lightly populated in the state, whereas region 5 lies near the heaviest population concentrations. Obviously these access costs, on their average, cannot be depended on to represent averages for all DNR camps. They do however, point up the necessity for confining comparisons to a single region, or at most to groups of regions with similar characteristics of population and resource distributions.
Comparisons of state parks and forest camps. It has been emphasized throughout this study that comparisons for investment choices should be confined to plans for similar service. It is recognized however that the members of the IAC as well as agency planners will be interested in how these two agencies compare in cost of service. Table 9 invites this kind of comparison.

It is revealing to note the fairly close parallels for the respective cost elements for the two agencies. Land costs are practically identical, though lower in region 5, for both agencies. Development costs are lower for forest camps but again favor region 5. Operating cost comparisons are more difficult because of the wide variation between regions for forest camps. State park operating costs are consistent between regions, slightly exceeding the average for forest camps. Access costs when averaged for each agency compare closely although the regional differences are reversed for the two regions. These patterns were discussed in an earlier section.

Summary of Comparative Evaluations

It should be emphasized at this point that the absolute values derived in analyzing these 22 plans should be considered only as broadly indicative of the range in cost of service. The quality of data has been described in Chapter VI, together with the adoption of assumed values where data were not available. A number of these assumed or estimated values could prove to be seriously in error. We have attempted to be as consistent as possible in using estimates which represent comparable experience, within the limits of our sources from a number of state agency planners.
Although we place rather low confidence in the absolute values calculated, we believe that relative values have merit for comparisons. Obviously we would like to have better estimates for a number of critical variables, particularly those which could vary between competitive sites or plans. Some locations may attract primarily families averaging four or five persons. Others may attract fishermen or hunters coming in smaller, mixed groups. The length of stay may be quite variable according to group make-up, activities offered and possibly source of clientele. The frequency and manner in which rated capacity is exceeded, especially for forest camps and for day visitors generally, is largely unknown. This contributes much uncertainty to attendance estimates. The proportioning of clientele by source areas was accomplished in this study entirely by judgement. Dependability of these estimates is critical in computing access costs, leading to appraisal of the locational advantage of given plans. Refinement of these and other estimates could lead to a greater degree of confidence in both absolute and comparative evaluations.

The comparisons reported in this chapter are meant to suggest the various uses which might be made of this system for analyzing a number of proposed plans. We have defined a system which includes the factors we feel should be considered in appraising the impact of new proposals. Inevitably policy makers may choose to weight some factors more heavily than others, or even disregard some elements of the system altogether. The system as developed is flexible enough to permit whatever weighting particular users feel is appropriate.
CHAPTER VII. PROBLEMS IN APPLYING THE SYSTEM

Application of this system for selecting high priority investments poses several new requirements for the planning and selecting agencies. These requirements will be discussed separately for the two criteria, efficiency and quality. Application of the system to existing parks will be discussed. The opportunities for application to development programming of several federal agencies are suggested. Computer programs are described for examining alternate assumptions regarding data inputs and for planning the strategy for improving data quality.

Employing the Efficiency Model

While both the evaluating agency and planning and development departments are concerned with accurate appraisals of efficiency, the major task of applying the efficiency model will fall on department planners. The data available from state planners for tests of the model were found to be deficient in several categories. Additionally it was learned that alternate plans are not normally made available for review by the approving agency. There were some attempts by the Department of Parks and Recreation (DPR) to plan for stagewise development.

Application of the system for selecting proposals will require more planning effort to provide for choices among sites and plans. Increased planning budgets will be required if selecting agencies are to have the opportunity for alternate allocations of funds.

In addition to planning more extensively planners will be required to provide several kinds of data not now secured. The first step in implementing the system consists of instituting data collection methods
at existing developments which would help to refine the estimates needed for new plans. The DPR could profitably analyze data now collected which would yield estimates of length of stay, origin, group size and travel patterns of camping visitors. Simple record keeping by operating personnel could add to present knowledge about these characteristics for day users.

Securing these and other data about visitors to forest campgrounds will require an interview sample approach. As personnel are employed to supervise and service these developments, they could be assigned to secure a modest sample of interviews on a scheduled basis. A single season of such samples, carefully taken to eliminate bias due to time, place and choice of respondent, would provide a start in refining estimates of group size, travel distance, length of stay and other critical variables.

Estimates of attendance are presently subject to much guesswork. State park superintendents use unchecked rules of thumb to convert traffic meter counts for each day to estimates of total visits. Even estimates of camper use are open to question since registration and payment are left to the volition of visitors after establishing their camps. All vehicles are assumed to carry an average of four persons. Refinements of these estimates should be possible using resident personnel under the direction of a trained investigator to secure better data.

Total use of forest campgrounds could be estimated using techniques described by Mattson and Bentley (16) or Wagar (39) and (40). These methods would require a trained investigator to make initial estimates for the first year, using agency personnel as assistants and trainees. These men could then carry on the system to provide daily, weekly or
seasonal estimates of use. Development of such a system could be combined with the interview survey described above.

Refinements in estimates of development and operating costs could undoubtedly be made, particularly for the Department of Natural Resources (DNR) plans. Present experience is rather limited in budgeting and accounting for these costs in the DNR. Careful accounting of both elements, when combined with improved use information will yield valuable insight for developing new plans. The DPR is accustomed to a stricter budgeting, site by site, both for development and operating costs. Their planners are expected to be able to predict costs for development within close limits, since there is little opportunity to shift funds from other accounts. Added precision will come from careful comparisons between estimates and performance for development projects and operating years.

Estimates of land values secured for this study were made without benefit of careful appraisal. Time did not permit more thorough study. In employing this system a consistent appraisal method should be developed which will yield market values on a common time base. This will permit inclusion of properties not yet secured, for comparison with alternate sites and plans. The effort spent in evaluating plans for available but unsecured properties will provide a better measure of potential efficiency gains than is now possible. Obviously such planning, at alternative scales, must be accomplished quickly since options to purchase are typically less than one year. With the system proposed here, assuming computer services are used, these plans can be examined as quickly as planners can complete the assembly of needed data. Advantages of completing the analysis of all cost and quality elements, for yet
unpurchased sites, are the opportunities provided to examine the trade-off possibilities between cost elements and to examine the opportunity costs of added quality. High quality sites at prices which seem out of line with properties now in the system might, because of favorable location, offer large savings to consumers in reduced access cost. If capacity is designed to make the fullest possible use of the site, cost per visitor day may prove to be competitive or even superior to that achievable by less accessible, lower cost sites. The scale economies possible at attractive, accessible developments may be such as to permit higher bidding for these properties than is now considered feasible on a judgment basis.

It appears likely that the extent of scale economies possible was not reached in any of the cases examined for this study. At this stage in park management experience (in this state) we do not know the effects on quality of service of very large scale developments. Nor can we clearly foresee where scale economies for development and operation may approach a maximum. With more experience in evaluating quality and efficiency for existing sites, as well as new plans, considerable insight will be gained of the trade-off possibilities between quality, land, development, operating and access costs.

Applying the Quality Criterion

In completing this study quality ratings were secured from the agency planners. Time did not permit securing ratings from independent judges. In the process of developing proposals, planning teams will surely want to include a consensus rating of quality. The selection agency will of
course secure its own evaluation. The essential steps in applying this criterion should be these:

1. A standard method (form) should be developed and used for all evaluations.

2. The weighting of the facets of quality should be determined and standardized by the selecting agency.

3. Final ratings for choice should be secured from a panel of independent judges, preferably three or more.

4. All proposals being compared at a given time should be rated by the same judges.

The quality rating form used in this study could be refined in a number of ways. Both independent judges and staff members should be invited to add to or subtract from the list of facets of quality and to recommend shifts in their relative weights. The resulting rating system could be further tested and modified by sampling user opinion at existing developments. By incorporating these refinements a system for rating quality of new proposals would result which should provide a high degree of reliability.

Application of the System to Existing Sites

While the system was developed and tested on available plans for two Washington agencies, it has numerous characteristics which recommend it for evaluating presently operating units. Operating agencies are under constant pressure to deliver more and higher quality service on limited budgets. Application of this evaluation system, using the most accurate data available would provide a means for directing improvement measures
where they are most needed. Serious departure from quality standards could be identified. Inefficient operations could be analyzed for casual factors. Needs for expansion, even added lands, could be pinpointed and documented. If such an evaluation system were incorporated as standard practice, healthy competition would be encouraged between the staffs of the various units of the system. Experience in using the system on existing developments, meeting the requirements for refined data collection, would lead to more precise evaluation of new proposals.

We have indicated the need for improved standardized methods of securing data on visitors and use patterns. Once these methods are perfected and administrative personnel are experienced with them, they can become standard operating procedure. Evaluation of efficiency and quality, for comparative purposes should be entrusted to independent analysts having no interest in the outcomes of their work except for its validity. Conscientious consultants so employed should be an excellent source of suggestions for improvements for all sites and plans examined.

Improving the Quality of Information

The model presented in this study for evaluating efficiency of recreation service requires estimated values for a large number of variables. Many of these values are now being estimated poorly or not at all. As efforts are planned to improve this knowledge guidance will be needed to direct this work toward the most productive channels. What is wanted is an understanding of how changes in the values for particular variables affect predicted costs. Alternate values may be proposed by different examiners or planners who honestly disagree over assumed values. Some
variables can only be estimated over a likely range of values. Whatever the reason, there is likely to be strong interest in exploring the results of alternate assumptions for many of the values estimated for a given plan.

In examining the sensitivity of these variables as they affect costs, a standard test is needed which will compare similar changes for each variable tested. A computer program (called "Simrun") was developed to provide the following evaluation of changes in output costs associated with incremental changes in instrument variables: (The program and a sample output are shown in the Appendix).

1. Output values were calculated for changes of selected instrument variables, one at a time, by 10% increments based on the point estimated values (equal to 100%).

2. The values calculated covered a range from 50% to 150% of the point estimate.

3. Output values were computed for total cost, for each of the five cost elements and separately for day visitor access and camper access costs.

4. The list of model variables in the program included all except annual rent, season length and camping units. These were expected to be known with certainty for any given plan.

5. Because of linkage between estimated values in the numerator and denominator of the fifth term (access cost), several evaluations of some numerator variables were made using alternate assumptions regarding changes in predicted attendance.
6. The program was run with standard data decks of 41 cards for a single year.

The effects of changing individual variables can be compared by curving these values. Examples are shown in Figures 13 and 14. Curves may be plotted for each affected cost element (Figure 13) or for groups of cost elements (Figure 14). (Some computers provide the capability of producing plots of these data as a part of the programmed solutions. This would provide the rapid direct comparison of selected plans for all important variables.)

The above program will provide insight into the nature of cost changes over a likely range of values for particular variables. These are logically called sensitivity tests. Particular plans may reveal a high sensitivity for some variables and cost elements, other plans showing a different pattern.

Planning the overall strategy to increase the reliability of the model by improving data quality, requires a standard comparison of all instrument variables. A third program ("Payoff") was written to provide such a comparison. The output from one sample run of this program is shown in Table 10. (It may be helpful to review the operating version of the model on page 74, above.) By applying a standard 10% increase to the point estimate for all instrument variables of interest we can identify those variables of particular concern and compare their relative sensitivity for influencing particular cost elements. For example if persons per car and per site (P and Y) are both increased by 10%, with a resulting increase in camper days (G), total costs are reduced by 5.46%. In this case all costs terms are equally affected. On the other hand if
Fig. 13 Variation in cost/visitor-day for changes in interest rate\(^a\)
(Chopaka Lake initial plan, 6th year)

\(^a\)Operating cost, not affected by changes in interest rate, is not shown.
Fig. 14  Variation in cost/visitor-day for changes in visitor days of camping (Chopaka Lake initial plan, 6th year)
### Table 10  
Percentage changes in costs per visitor day (D Values)\(^a\) for a 10% increase in variables listed\(^b\) (Mayfield Lake State Park, initial plan, first operating year)

<table>
<thead>
<tr>
<th>Affected Variables</th>
<th>Value of First Var.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO</td>
<td>Land value $1,167,770.00</td>
</tr>
<tr>
<td>I</td>
<td>Interest rate 0.06</td>
</tr>
<tr>
<td>B</td>
<td>Gestation period, yrs 2.00</td>
</tr>
<tr>
<td>G &amp; U</td>
<td>Campers: visitor days; use rate 32,657.00</td>
</tr>
<tr>
<td>H, W1 &amp; W2</td>
<td>Visits: day visitors. Use rates: peak; non-peak 47,540.00</td>
</tr>
<tr>
<td>EK</td>
<td>Development costs--infinite life $357,050.00</td>
</tr>
<tr>
<td>C4</td>
<td>Operating costs $45,618.00</td>
</tr>
<tr>
<td>K</td>
<td>Travel cost/mile--campers $0.10</td>
</tr>
<tr>
<td>Y &amp; G</td>
<td>Campers/site, visitor days--campers 4.67</td>
</tr>
<tr>
<td>L</td>
<td>Length of stay--campers, days 3.40</td>
</tr>
<tr>
<td>P</td>
<td>Persons/car--campers 4.67</td>
</tr>
<tr>
<td>P, Y &amp; G</td>
<td>Campers: persons/car, persons/site, visitor days 4.67</td>
</tr>
<tr>
<td>R &amp; H</td>
<td>Peak season days, day visits 37.00</td>
</tr>
<tr>
<td>W1 &amp; H</td>
<td>Peak season use rate, day visits 0.50</td>
</tr>
<tr>
<td>W2 &amp; H</td>
<td>Non-peak season use rate, day visits 0.02</td>
</tr>
<tr>
<td>K1</td>
<td>Travel cost/mile--day visitors $0.07</td>
</tr>
<tr>
<td>T &amp; H</td>
<td>Turnover rate, day visits 1.52</td>
</tr>
<tr>
<td>P1, X1, &amp; H</td>
<td>Day visitors: persons/car, capacity, visits 5.00</td>
</tr>
<tr>
<td>P1, X1, W1, W2</td>
<td>Day visitors: persons/car, capacity, and use rates: peak season, non-peak season 5.00</td>
</tr>
<tr>
<td>MS</td>
<td>Average travel distance--day visitors, miles 62.90</td>
</tr>
<tr>
<td>MQ</td>
<td>Average travel distance--campers, miles 88.62</td>
</tr>
</tbody>
</table>

\(^a\)D values identify the following cost elements: D1 = Total; D2 = Land; D3 = Development; D6 = Access cost.

\(^b\)Secondary variables listed were recalculated based on the choice of which variables were allowed to change.
A 10% increase in the first variable listed and corresponding changes in the other variable were held constant.

<table>
<thead>
<tr>
<th>Value of First Var.</th>
<th>Terms Affected</th>
<th>% of D1 in Affected Terms</th>
<th>Percentages a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>D1</td>
</tr>
<tr>
<td>57,770.00</td>
<td>D2</td>
<td>25.7</td>
<td>2.57</td>
</tr>
<tr>
<td></td>
<td>D2,D3,D4</td>
<td>45.9</td>
<td>4.63</td>
</tr>
<tr>
<td>2.00</td>
<td>D2,D3,D4</td>
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<td>0.54</td>
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<tr>
<td>32,657.00</td>
<td>A11</td>
<td>100.0</td>
<td>-4.35</td>
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<td>0.10</td>
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<td>3.40</td>
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<td>-5.46</td>
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<td>37.00</td>
<td>A11</td>
<td>100.0</td>
<td>-1.02</td>
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<td>0.50</td>
<td>A11</td>
<td>100.0</td>
<td>-1.06</td>
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<td>0.02</td>
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<td>100.0</td>
<td>-0.38</td>
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<td>D6</td>
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<td>2.73</td>
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<tr>
<td>1.52</td>
<td>A11</td>
<td>100.0</td>
<td>-1.42</td>
</tr>
<tr>
<td>5.00</td>
<td>A11</td>
<td>100.0</td>
<td>-4.04</td>
</tr>
<tr>
<td>5.00</td>
<td>D6</td>
<td>39.2</td>
<td>-2.46</td>
</tr>
<tr>
<td>62.90</td>
<td>D6</td>
<td>39.2</td>
<td>2.73</td>
</tr>
<tr>
<td>88.62</td>
<td>D6</td>
<td>39.2</td>
<td>1.19</td>
</tr>
</tbody>
</table>

* = Developments, infinite life; D4 = Developments, finite life; D5 = Operating cost; D6 = Developments, infinite life; D4 = Developments, finite life; D5 = Operating cost;
camper length of stay (L) is increased 10% (with no change in G), total cost is reduced by only 1.8%, affected by camper access cost, the fifth term (D6). Comparisons provided by this table yield immediate guidance in selecting variables for which prediction is critical.

In developing the strategy for securing improved data a number of plans should be compared for each agency. Figure 15 presents data from the "Payoff" program averaged for 10 state park plans. This figure provides comparisons of averages for changes in total cost and state costs when instrument variables are increased by 10%. Similar comparisons could be prepared for individual elements of cost where interest centers on particular cost terms.

The first supplementary program allows the exploration of alternative assumptions regarding predicted values in a given plan. The second can be used to plan the strategy for securing improved data. It also provides guidance on the standards of accuracy required of these estimates.

Applicability to Other Agencies

Other state agencies

In this study test applications were confined to two state agencies which together provide a major portion of state services in Washington. Two other state departments have continuing development programs and expanding levels of recreation service: Highways and Game. Mention was made of efforts to examine plans of the Game Department. Their capital developments include little or no accommodations for visitors except for fish hatchery demonstrations. As presently funded these development programs are not clearly susceptible to comparative evaluations under our system.
<table>
<thead>
<tr>
<th>Instrument Variables</th>
<th>Percent changes in:</th>
<th>Total Costs</th>
<th>State Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>V0</td>
<td>-10% -5% 0 +5% +10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G, U</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H, W1, W2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y, G</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P, Y, G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R, H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W1, H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W2, H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T, H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1, X1, H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1, X1, W1, W2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MQ</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 15 Average changes in total costs and state costs when values for instrument variables are increased by 10%. Data taken from 10 state park plans, sixth operating year.

\[a\] The first variables listed are increased 10%. Secondary variables shown were recalculated because of linkage with primary variables. All other variables are held constant.
The Highway Department has recently embarked on expanded development of highway rest areas. The style of these small, intensively developed areas is fairly well standardized. Location appears to be dictated by (a) traffic flows, (b) spacing and (possibly) (c) available parcels of land acquired along with right-of-way purchases. Quality may not vary appreciably, since most visitors stop only long enough to use rest room facilities, now of similar age and design.

Should this type of development be modified to encourage longer stops, for example for picnicking or possibly overnight service, they would begin to supply the needs for vacationers for the "motel" type stop or traveller camp. This type of development could be evaluated for comparative rating with alternate plans and sites using a modified form of our system. Quality differences should appear which would reflect natural cover, scenery, freedom from traffic noise and numerous other characteristics. Access costs would logically be computed using distance from similar units along major travel routes. Land, development and operating costs would reveal potential trade offs with quality values. Prediction of use rates would prove difficult until experience had been gained from several existing units for which careful records were kept and analyzed.

**Federal agencies**

There are two federal agencies (in Washington) with active continuing development programs: U.S. Army Corps of Engineers and the U.S. Forest Service. Both of these agencies are faced with rising pressures from the visiting public. Both are under federal instruction to comply
with the guidelines provided by the Bureau of the Budget for application of the planning-programming-budgeting (PPB) system (5). This bulletin states in part "The principal objective of PPB is to improve the basis for major program decisions. ... Program objectives are to be identified and alternative methods for meeting them are to be submitted to systematic comparison." (5, p. 1) Researchers for the Bureau of Outdoor Recreation have attacked the problem of applying these guidelines to recreation investments as was discussed in an earlier chapter (33). Our system goes considerably beyond the evaluation they employed and explicitly includes quality and travel cost as bases for comparison.

The services rendered by the Forest Service overlap and compete with developments of both state agencies studied. They frequently serve the same clientele at developments which range from small primitive facilities to those resembling modern state parks. Their cost patterns should compare with similar state developments in all respects. The scope of planning in this agency is obviously broader than any single Washington agency. The Forest Service has developed a centralized data bank to aid in budgeting and decision making entitled Recreation Information Management (RIM) (30). This in-service training guide describes a system for assembling data regarding existing facilities and attendance, for use in developing system wide budgets and development plans. Application of our method for screening proposed plans would be a natural concomitant of this broad planning approach. It would materially assist in budgeting for efficient use of funds. It would also provide a quantitative measure of effectiveness for top level review. Data accumulated through implementation of the RIM system should be useful in predicting many of the variable
values required by the efficiency model we have developed. Experience in using this model should build up rapidly if applied to existing units in selected districts or forests.

Application by the Corps of Engineers to the selection of favored sites for development would be best approached on a river basin level. Opportunities for choice on a given reservoir project are likely to be rather limited. River basin planning permits a regional approach to identifying need, specifying clientele areas and explicit consideration of existing facilities and the plans of other agencies. The difficulties posed by the basin approach are: (1) Identifying the appropriate agency to make choices and (2) determining the proper agencies to undertake funding, development and operation. In order to achieve a regional or full basin approach all agencies providing recreation service must be involved in solving these two problems. Given this scope of planning, our model will provide an excellent screening device for development programming.

At the national level, planning for national recreation areas (NRA's) could be subjected to the evaluation process proposed here. Proposals for new NRA's are being promoted faster than funding is available. Congress would welcome a yardstick by which to measure the effectiveness of alternate areas, alternative development plans and the relative effectiveness of alternate staging proposals. While other criteria might be deemed important (e.g., geographic distribution) the basic criteria of quality, efficiency and location relative to people are part of established policy for selecting suitable projects.

While this study has addressed the problem of choice faced by public agencies, the selection system developed has obvious application for
private investments. With the rapid expansion of private offerings becoming more and more competitive with public facilities, investors are in need of careful appraisal of alternate opportunities. Feasibility studies could be made by direct application of this evaluation system. Prediction of some variables would be difficult, as in the case with public projects, however, the use of the simulation program (Simrun) would allow alternate assumed values to be tested rapidly. Ranges in cost per visitor day would provide excellent guidance for pricing policy. The structured approach for identifying the relative size of cost elements provides immediate guidance for exploring alternate means for achieving greater efficiency. Consultants employed to develop project plans could profitably use this system and should rapidly develop the experience to help provide many of the data required for complete analyses of quality and efficiency.
CHAPTER IX. SUMMARY AND CONCLUSIONS

At the beginning of this study we proposed to develop and test a method for systematic comparison of action programs to provide a more effective means for meeting the goals of comprehensive plans. We have developed and tested such a system which incorporates the major criteria employed by most states for selecting projects for development. The system presented includes explicit measures of quality and efficiency, permitting direct comparison of competing proposals.

Application of the system requires the decision making agency to assign relative weights to criteria of quality and efficiency. Selection of projects is guided by comparing and ranking a number of alternate plans for one or several sites. Choices are made within chosen planning regions among alternatives which provide similar service. These choices are made to accomplish specific goals established in the state plan.

The adoption of this system by a state or federal agency imposes a requirement to examine closely the planning methods and capabilities of the various agencies involved. On the criterion of quality there appears to be little evidence that comparisons are being attempted, either to evaluate sites or alternate plans. The approach taken here proposes that, by structuring the appraisal of quality, giving explicit attention to individual facets of design and site features, comparison ratings can be achieved. Quite obviously such a rating system can only be perfected after numerous test applications and revisions. Repeated practice in using this structured approach would tend to make planners themselves more critical and analytical of development needs and possibilities. The
use of a standardized form would provide the means for identifying differences of opinion among appraisers. It should certainly aid in reaching a consensus on the comparative merits of plans. Planners consulted during this study described the difficulty they often encountered in defending certain features of their plans. They were seldom in the position of having explicit alternatives to offer. The use of a standard evaluation system by staff members and supervisors should assist in refining weak features of initial proposals. At the time of presentation to reviewing agencies, planners could point out the alternative features considered and eliminated.

The relative weights assigned to the various facets of quality would undoubtedly differ according to the experience of the agency officials responsible for developing and administering the system. A certain amount of trial and revision might be required to perfect the desired balance of weightings. The adjustment period could be accomplished fairly rapidly by application to existing units of the system. This would provide the full range of conditions and sites likely to be encountered in new proposals. It would provide an excellent comparative review of current conditions with obvious implications for improvement and upgrading of older, rundown parks.

The job of developing the final quality rating system together with guidelines for application could well be contracted to consultants. However, they should be instructed to work closely with both planners and unit managers, whose contributions to the final system should be both real and substantial. These agency people should feel a strong sense of commitment to the system as finally developed.
This study was conceived and developed to provide a system for evaluating planned proposals. At several points we have suggested that refinements of the system and testing experience could be gained by applying it to existing sites. Applications of this kind would inevitably lead to evaluations of the quality of service rendered by the operation and management of these sites. For applications to proposed plans we necessarily omitted appraisal of service quality through management efforts. It should appear obvious, with a moment’s reflection, that there must be a strong interaction between site and design features on the one hand, and ease and quality of management on the other. It is for this reason that we urged in the previous paragraph that unit managers be given an active role in developing any system for evaluating quality and efficiency of new plans.

Should an agency undertake to perfect a system of evaluation for existing sites it would seem most logical to develop a quality rating system for management service. Visitor reaction, properly sampled, would be a logical component of such a rating process. Agency supervisors would undoubtedly include their own standard inspections as another component.

It is not our intent to propose such a system for evaluating quality of service. Rather, we wish to emphasize that this element of quality should be subjected to regular, standardized evaluation in any continuing strategy to provide better and more efficient service. While this evaluation can only be applied to operating units, the experience gained should provide many valuable clues to planners. They should become more expert in designing both higher quality and more efficient units.
In developing our efficiency model, we have insisted that all relevant costs must be appraised. Certainly this approach is no different from the appraisals undertaken by private suppliers of services. The costs of all resources to be invested plus the costs to operate the system must be estimated in terms of units of service. The relative ease with which potential customers can avail themselves of the service must be given careful attention, especially as it influences the location of the exchange.

Public agency officials are seldom subject to the discipline of market competition for profit. They are, however, frequently expected and asked to document the efficiency of their management of publicly-owned resources. In the field of recreation there are few yardsticks to provide comparisons. In fact, except for costs of management, there is virtually no attempt to report public costs of recreation in units of service rendered. Legislators can certainly be expected to ask pertinent questions when requested to authorize large sums for new parks or increased operating budgets.

The adoption of our system for appraising new plans (or existing units) would provide agency officials with powerful arguments when going before legislators with new requests. The documentation provided by a standardized system of comparison, fairly applied and achieving a balance between quality and efficiency, should reassure these decision makers that they can allocate public funds wisely and defensibly.

Our efficiency model specifies several kinds of data not presently available, even for operating units. We have suggested several steps which could be taken to secure these data, particularly through analysis
of operating units. The services of consultants would be especially valuable here.

Efforts to refine the system, especially while some of the data are being built up, will be facilitated by use of the two supplemental computer programs supplied. Standards of accuracy to be required for the variables being estimated will pose recurring problems. Testing the effects of ranging the values of chosen variables can be accomplished easily with the Simrun program. Comparing the relative sensitivity of all variables can be done for individual or groups of plans by employing the Payoff program. These two programs will assist in the efficient and rapid perfection of the final evaluation system.

A few of the opportunities for applying this system were mentioned in the last chapter. In particular, we feel that any agency which is being pressed to adopt the planning-programming-budgeting system (PPBS) should be quick to see the possibilities inherent in our approach.

The conditions required to implement the system are relatively few:

1. A single agency is charged with recommending or choosing among alternative investments.

2. Needs for various kinds of service are specified.

3. A number of alternative sites and plans are available for comparison.

4. The relative weights of the various criteria can be specified.

5. (Helpful but not required) Access is available to the services of a computing center.

As we observe the mounting programs of recreation investments and operating budgets at all levels of government, it seems inevitable that
these programs must come under increasing scrutiny. Responsible officials must constantly assure themselves and their publics that these funds are being used in the most effective manner. Adoption and refinement of the system developed in this study will provide a powerful tool for guiding and defending the allocation of our resources for public recreation service. The fledgling effort of private industry to supply services in competition with many public facilities faces a high degree of market uncertainty. Investors require careful, thorough exploration of the feasibility of alternate plans. Guidance is often required in setting prices. The evaluation system proposed has obvious application in solving both of these problems.

Addendum

Since completing the above section, the author has learned of the recent work directed by the U.S. Water Resources Council to establish new principles and standards for planning water and land resources. Work began in 1969 as a result of mounting dissatisfaction with evaluation procedures for determining project feasibility under policies established in Senate Document 97 (34). New principles (54) and standards (55) have been proposed to supersede those now in effect. In the study leading up to these new proposals, numerous hearings were held and 19 test applications were made to currently planned development projects.

These new principles are of interest to the subject of this paper in several aspects. Whereas the current practice of evaluating projects rests primarily on the criterion of national efficiency gains expressed
by the benefit-cost ratio, the new principles would establish four criteria or objectives for evaluating water and land development projects. These are: national economic development, quality of the environment, social well-being and regional development. In application this involves advance determination of weights to be assigned to the four accounts in order to develop comparative ratings for competing plans. The task force recommended that all objectives be considered equally important. A start has been made in this study in applying multiple criteria for the selection of recreation investments, quality and efficiency.

Second, the task force recommendations (56) emphasize that (a) a number of alternate plans at different scales will be required to permit comparisons for choice, and (b) these will provide opportunity to examine trade-offs among objectives. Both of these points have been made in Chapter VIII regarding uses of our system.

A number of thoughtful reports have discussed the problems of implementing a multiobjective procedure for selecting public investments in natural resource development. A group led by Robert J. Kalter (57) at Cornell University has addressed several of the serious problems raised by the proposed new procedures. They urge the separation of accounting under the respective accounts, even though they in fact overlap for specific benefits and costs. This is important to permit identifying trade-offs in quantitative terms. As they also point out, careful accounting by objectives will facilitate recognition of gains or losses in income distribution, since beneficiaries and cost-bearers will necessarily be identified (57).
The choice model developed in this study is the first (so far as is known) to introduce consumer costs explicitly into the efficiency criterion. Under the proposed new standards these "transfer" costs could be entered in the social well-being account to the extent they exceeded the minimum costs achievable among the alternative sites considered for choice.
BIBLIOGRAPHY


45. Washington Parks and Recreation Department. Benefit cost evaluation of recreation projects and resources. (Mimeographed memorandum to park planners.) Olympia, Washington, author. ca. 1969. (This undated in-service memorandum was secured from Robert Reiter, Regional Planner, February, 1969).


Addendum


ACKNOWLEDGMENTS

This study was supported in part through Research Project 1914 of the Agricultural Research Center at Washington State University. Funds were provided by both the State of Washington and the McIntire-Stennis research program administered by the U.S. Department of Agriculture.

I wish particularly to acknowledge the counsel and advice of my major professor, Frederick S. Hopkins, who inspired and encouraged me when I needed it most. Valuable assistance in assembling the data was given by Howard Hannigan and Robert Reiter of the Washington Department of Parks and Recreation and by Fred Hart, Terry House, John Kingsberry and E. Walter Smith of the Department of Natural Resources. Several of my colleagues at Washington State University gave much appreciated editorial advice and help. Particular thanks are due R. W. Bruce, Leon Pienaar, David Baumgartner of this staff. My special thanks go to Mrs. Maxine Andrews, who gave invaluable help in preparing a high-quality manuscript. Most of all I want to thank my wife, Elsie, and our children whose confidence and trust in me never faltered and without whose patient understanding I could not have completed this task.
APPENDIX

This appendix contains the three computer programs written in Fortran IV, G level 1, mod 4 language. They have been provided with comment or explanation lines (cards) inserted to assist potential users in adapting this system to their own needs. All comment cards are marked "C" in the first column and the words or symbols are printed at the top. When program decks are reproduced, these cards can be withdrawn to speed the program runs for desired calculations. A competent computer programmer should be employed for adapting this program to particular uses.

The data decks are produced on 41 cards as shown in Forms 4-1, 2, 3 on pages 107, 108, and 109. Coding on standard IBM cards is indicated by numbered boxes. The first 15 boxes (columns) serve to identify the site plan and year and are reproduced on each card in the deck. All other lines in the form constitute one card each.

The first program presented is called the Efficiency Program. It was used to compute the output values presented and discussed in Chapter VII. The printout for each plan consists of 16 output values (D1 to D-14 plus average travel distance for campers and day-visitors). Values are printed for each year of estimate (one deck for each) and for the simple average of these two years. During the course of this study, jobs were submitted to the IBM 360-67 computer in batches of 10 to 22 plans (20 to 44 data decks). The average computer time per plan was 0.9 seconds.
EVIDENCE PROGRAM

This program is the source for the information on cost per visitor.

This program calculates cost per visitor day for all cost elements in a given plan. Two data decks are used, representing estimates for separate years. The resulting output values represent the average for the chosen years.

DIMENSION M(I(10),J(10),S(5),J(5),T(15)),D(14),FST(16),TITLE(215)

K2 = 1
K1 runs control so that two sets can be processed at a time.

1001 K1 = K1 + 1

This branch gives different id name for second data set.
READ(5,3) B
3 FORMAT(T21,F10.0)
READ(5,4) A
4 FORMAT(T121,F10.0)
READ(5,5) G
5 FORMAT(T121,F10.0)
READ(5,6) H
6 FORMAT(T121,F10.0)
READ(5,7) FK
7 FORMAT(T121,F10.0)
C THIS IS A SIDE CALCULATION TO BE USED LATER IN COMPUTING COST FACTORS
C3=0.0
DU 199 KIT=1,4
READ(5,8) EF*I
8 FORMAT(T21,F10.0,19,F2.0)
19 FORMAT(T21,F10.0,19,F2.0)
IF(F.EQ.0.) GO TO 189
DISC=1+1).*EF*I*(1+1)**F/((1+1)**F-1)
189 C3=C3*EF*DISC
199 CONTINUE
C READING INPUT CONTINUES
READ(5,12) G4
12 FORMAT(T21,F10.0)
READ(5,13) CST
13 FORMAT(T21,F10.0)
READ(5,14) X
14 FORMAT(T21,F10.0)
READ(5,15) Y
15 FORMAT(T121,F10.0)
READ(5,16) Z
16 FORMAT(T121,F10.0)
READ(5,17) U
17 FORMAT(T21,F10.0)
READ(5,18) L
18 FORMAT(T121,F10.0)
READ(5,19) P
19 FORMAT(T21,F10.0)
READ(5,20) R
20 FORMAT(T21,F10.0)
READ(5,21) W1
21 FORMAT(T21,F10.0)
READ(5,22) W2
22 FORMAT(T21,F10.0)
READ(5,23) CST1
23 FORMAT(T21,F10.0)
READ(5,24) X1
24 FORMAT(T21,F10.0)
READ(5,25) T
25 FORMAT(T21,F10.0)
READ(5,26) P1
26 FORMAT(T21,F10.0)
DO 10 K=1,10
10 READ(5,27) M(K), J(K)
27 FORMAT(T21,F10.0,F10.0)
C SUM ACCESS DIST. FOR D-V AND CAMPERS.
DO 11 K=1,5
11 READ(5,37) S(K), J(K)
37 FORMAT(T21,F10.0,F10.0)
MQ=0.0
DO 200 K=1,10
200 MQ=MQ+M(K)*J(K)
MS=0.0
DO 202 K=1,5
202 MS=MS+S(K)*J(K)
FURTHER SIDE CALCULATIONS
C1=V0*(1+I)**B*I+A*(1+I)**B
C2=E*(1+I)**B*I
DEN=G+H/2.
IF(P1.EQ.0) GO TO 3000
C5D=CST1*(R*W1+(Z-R)*W2)*X1*T/P1*MS*4.
GO TO 3001
3000 C5D=0.0
3001 IF(L.EQ.0.OR.P.EQ.0) GO TO 3002
DO 300 K=1,14
C STORE COST VALUES AND ID

IF (K .LE. 1) GO TO 2000
C IF THIS IS THE SECOND TIME DROP OUT OF LOOP

*******************************************************************

C COMPUTATION OF COSTS

*******************************************************************

3003 C5=CS5+C5/2.
3002 CS5=0.0
GO TO 3003
C5=(2.*C51+U*X*Z2+R1)/L1P}

3202 D(9)=C1+C2/DEN
3201 D(8)=0.0
60 TO 3202
08=80/H
3200 IF (H.EQ.0) GO TO 3201
3100 D(7)=0.0
60 TO 3100
07=C5/6
IF (6.EQ.0) GO TO 3100
06=CS/DEN
05=C4/DEN
04=CS/DEN
03=CS/DEN
02=CS/DEN
01=(C1+C2+C4+C5)/DEN
C1=(C1+C2+C4)/DEN
D(1)=C1+C2+C4/DEN

C THIS IS THE SECOND TIME DROP OUT OF LOOP

*******************************************************************
KPLN1=KPLAN
IF(KI.GE.2) GO TO 2000
C GO GET ANOTHER SET OF DATA ELEMENTS
GO TO 1001
C **************************************************************

2000 KI=0
C ARE THERE TWO TABLES ON PAGE ALREADY?
IF(KZ.NE.1) GO TO 320
KZ=KZ+1
C PRINT TABLE HEADING
WRITE(6,104) TITLE,KSIT1,KYR1,KPLN1,TITLE2,KSITE,KYR,KPLAN
104 FORMAT(1,'5A4,5X,I2,2X,13,2X,I1,T40,5A4,5X,I2,2X,13,2X,I1,T83,' A
*VERAGE',//)
GO TO 289
320 WRITE(6,103) TITLE,KSIT1,KYR1,KPLN1,TITLE2,KSITE,KYR,KPLAN
103 FORMAT(//'///,1X,5A4,5X,I2,2X,13,2X,I1,T40,5A4,5X,I2,2X,13,2X,I1,T8
*3,' AVERAGE',//)
KZ=1
C COMPUTE AVERAGES
289 DO 299 K=1,14
    AVE=(FST(K)+D(K))/2.
C THIS BRANCH PROVIDES FOR "D1" TO BE PRINTED INSTEAD OF "D 1"
    IF(K.GE.10) GO TO 204
WRITE(6,100) K,FST(K),K,D(K),AVE
100 FORMAT(1X,'D',I1,3X,F10.4,T40,'D',I1,3X,F10.4,T80,F10.4)
GO TO 299
204 WRITE(6,101) K,FST(K),K,D(K),AVE
101 FORMAT(1X,'D',I2,2X,F10.4,T40,'D',I2,2X,F10.4,T80,F10.4)
299 CONTINUE
C AVERAGE MQ AND PRINT THE RESULTS
AVE=(FST(15)+MQ)/2.
WRITE(6,201) FST(15),MQ,AVE
201 FORMAT(' MQ ','F8.4,T40,' MQ ','F8.4,T82,F8.4)
C AVERAGE MS AND PRINT THE RESULTS
AVE=(FST(16)+MS)/2.
WRITE(6,203) FST(16),MS,AVE
The Simrun Program, presented on the following pages, has been developed to be run with a single deck of data cards for each set of output values secured. Each variable in turn is assigned eleven alternate values ranging from 50% through 150% of the original estimated value. Eight output values (costs per visitor day) are computed for 10% increments of the variable under consideration. Since this printout is rather voluminous, the results can be more easily comprehended by curving these values as shown in Figures 13 and 14 in Chapter VIII. Computer time per plan averaged 1.7 seconds.
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C*********************************************************************
C THIS PROGRAM HAS BEEN DESIGNED TO LET THE PERSON INSTRUMENTING IT
C TO FIND THE EFFECT OF CHANGES IN THE VALUES OF THE INPUT VARIABLES ON
C THE COST FIGURES, D1-DB, BY RUNNING EACH VARIABLE (ONE AT A TIME) THROUGH
C A RANGE FROM 50 PERCENT OF ITS INPUT VALUE TO 150 PERCENT.
C TO DETERMINE THE RELIABILITY OF THE COST ESTIMATES IN VIEW OF THE
C ESTIMATES MADE FOR THE INPUT VALUES WITHOUT CONSTANT REVISIONS BEING
C MADE IN THE DATA INPUT DECK.
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C**************************************************************************
C*********************************************************************
IMPLICIT REAL*4 (A-H,K-Z)
C ARRAY D - INPUT VALUES
C ARRAY C - SUBCALCULATIONS
C ARRAY DI - COST ESTIMATES
C ARRAY I CODE - SITE ID
C DIMENSION D(68),C(10),DI(16),ICODE(3)
C THIS SUBROUTINE READS IN DATA
C 150 CALL INPUT(D,I STOP,I CODE)
C IF END OF DATA REACHED PROGRAM TERMINATES
C IF (I STOP.EQ.3) STOP
C THE FOLLOWING CALCULATIONS ARE AN INTERMEDIATE STEP IN REACHING
C VALUES FOR COST FACTORS (DI)
C MS=0.0
C MQ=0.0
C DD 21 J=1,10
C 21 MQ=MQ+D(37+2*J)*D(38+2*J)
C DD 22 J=1,5
C 22 MS=MS+D(57+2*J)*D(58+2*J)
C(1)=C3(D)
C(2)=D(4)*D(11)+1.*D(11)*D(10)+D(12)*D(10)+1.*D(11)
C(3)=D(15)*D(10)+1.*D(11)*D(10)
C(4)=D(13)+D(14)/2.
C(5)=0.0
IF(D(38),NE.0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36) 41*D(37)/D(38)*MS*4  
C(6)=0.0  
IF(D(30)*D(31).NE.0)C(6)=12*D(25)*D(29)*D(26)*D(28))/MQ*D(27)/  
1{D(30)*D(31)}  
C(7)=C(6)+C(5)/2.  
C(8)=D(24)  
C(9)=D(13)  
C(10)=D(14)  
C COMPUTES DI(1)-DI(14)  
300 CALL SUBDI(C,DI)  
C PRINTS HEADING,DI(1)-DI(14),MS,MQ OBTAINED FROM INPUT  
CALL PRINT2(D,DI,MS,MQ,ICODE)  
C *****************************************  
C NEW PAGE  
898 FORMAT('')  
C *****************************************  
C RANGE FUNCTIONS FOLLOW  
C HEADING FOR SIMULATION TABLE  
WRITE(6,2000)  
2000 FORMAT('V',47X,'D1',7X,'D2',7X,'D3',7X,'D4',7X,'D5',7X,'D6',  
1 7X,'D7',7X,'D8')  
C *****************************************  
WRITE(6,901)  
901 FORMAT('+'(OF'VOICE')  
CALL RNG1(C,DI,D)  
C *****************************************  
WRITE(6,2000)  
WRITE(6,902)  
902 FORMAT('+'(OF 'IND')  
IND=10  
CALL RNG2(C,DI,D,IND)  
C *****************************************  
WRITE(6,2000)  
WRITE(6,903)
903 FORMAT(* OF B1)
905 CALL RNG2(C,D1,D1,IND)
906 WRITE(6,900)
907 CALL RNG5(C,D1,D1,IND)
908 FORMAT(* OF G WITH W1 AND W2,*)
909 FORMAT(* OF H WITH M1 AND M2,*)
910 IF(1+I*2) GO TO 926
911 DO 725 IJ=1,4
912 IF(DJ(EQ.0) IJ=10,10,10)
913 WRITE(6,299)
914 CALL RNG8(C,D1,D1)
915 WRITE(6,299)
916 CONTINUE
917
726 WRITE(6,898)
WRITE(6,2000)
WRITE(6,912)
912 FORMAT('+ ( OF C4*)
CALL RNG12(C,DI,D)
C
******************************************************************************
WRITE(6,2000)
WRITE(6,913)
913 FORMAT('+ ( OF K*)
IND=25
CALL RNG13(C,DI,D,MQ,IND)
C
******************************************************************************
WRITE(6,2000)
WRITE(6,915)
915 FORMAT('+ ( OF Y WITH G*)
IND=27
CALL RNG5(C,DI,D,MQ,IND)
C
******************************************************************************
WRITE(6,898)
WRITE(6,2000)
WRITE(6,918)
918 FORMAT('+ ( OF L*)
IND=30
CALL RNG13(C,DI,D,MQ,IND)
C
******************************************************************************
WRITE(6,2000)
WRITE(6,919)
919 FORMAT('+ ( OF P*)
IND=31
CALL RNG13(C,DI,D,MQ,IND)
C
******************************************************************************
WRITE(6,2000)
WRITE(6,1919)
1919 FORMAT('+ ( OF P WITH Y AND G*)
CALL RNG198(C,DI,D,MQ)
C
******************************************************************************
WRITE(6,898)
WRITE(6,2000)
WRITE(6,920)
920 FORMAT('+ ( OF R WITH H**)
J=32
CALL RNG20(C,DI,D,MS,J)
C
********************************************************
WRITE(6,2000)
WRITE(6,921)
921 FORMAT('+ ( OF W1 WITH H**)
J=33
CALL RNG20(C,DI,D,MS,J)
C
********************************************************
WRITE(6,2000)
WRITE(6,922)
922 FORMAT('+ ( OF W2 WITH H**)
J=34
CALL RNG20(C,DI,D,MS,J)
C
********************************************************
WRITE(6,898)
WRITE(6,2000)
WRITE(6,923)
923 FORMAT('+ ( OF K**)
CALL RNG23(C,DI,D,MS)
C
********************************************************
WRITE(6,2000)
WRITE(6,925)
925 FORMAT('+ ( OF T WITH H**)
J=37
CALL RNG20(C,DI,D,MS,J)
C
********************************************************
WRITE(6,2000)
WRITE(6,926)
926 FORMAT('+ ( OF P1 WITH X1 AND H**)
IND1=36
IND2=38
**SUBROUTINE SUBDI(C, D)**

**SAME SUBROUTINE AS IN OTHER PROGRAM**

**FUNCTION C(D)**

**SAME SUBROUTINE AS IN OTHER PROGRAM**

**SUBROUTINE INPUT(DATA, INP, CODE)**

**SAME SUBROUTINE AS IN OTHER PROGRAM**

END

GO TO 150

RETURN TO BEGINNING AND READ IN ANOTHER SITE PLAN

CALL RNGMA(C, 0.0, 1.0, 0.0)

928 FORMAT(15, 0. MF)

WRITIE(6, 928)

WRITIE(6, 2000)

CALL RNGMS(C, D, D)

927 FORMAT(15, 0. MS)

WRITIE(6, 927)

WRITIE(6, 2000)

CALL RNGS6(C, D, D, MS)

1926 FORMAT(15, 0. MS, 1) OF PL WITH XI AND WI AND M2)

WRITIE(6, 1926)

WRITIE(6, 2000)

WRITIE(6, 898)

CALL RNG6(C, D, MS, INDI, IND2)
C SINCE ONLY D(1)-D(8) ARE USED IN THE SIMULATION THIS ENTRY POINT WAS MADE.
ENTRY SUBD(C, D)

D(8) = 0.0
IF(C(10) .NE. 0) D(8) = C(5)/C(10)
D(7) = 0.0
IF(C(9) .NE. 0) D(7) = C(6)/C(9)
D(6) = C(7)/C(4)
D(5) = C(8)/C(4)
D(4) = C(1)/C(4)
D(3) = C(3)/C(4)
D(2) = C(2)/C(4)
D(1) = (C(2) + C(3) + C(1) + C(8) + C(7))/C(4)
RETURN

C SUBROUTINE PRINT2(D, DI, MS, MQ, ICODE)
IMPLICIT REAL*4 (A-H, K-Z)
DIMENSION D(6), D(16), ICODE(3)
WRITE(6,70) D(5), D(6), D(7), D(8), D(9), ICODE
70 FORMAT('1',IX,5A4,5X,12,2X,13,2X,II,//)
WRITE(6,69)
69 FORMAT(' POINT ESTIMATES ')
DO 75 J = 1, 14
WRITE(6,71) J, D(J)
71 FORMAT(' D*,I2,2X,F10.4)
CONTINUE
WRITE(6,76) MQ
76 FORMAT(' MQ ',F10.4)
WRITE(6,77) MS
77 FORMAT(' MS ',F10.4)
RETURN
SUBROUTINE RNG1(C,D,D)
DIMENSION C(10),D(14),D(68)
STORE THE VALUES TO BE CHANGED
TEMP=D(4)
TEMP1=C(2)
RUN VARIABLE THROUGH RANGE
DO 201 J=5,15
GET NUMBER FOR "( " IN OUTPUT
I=J*10
GET NEW VALUE FOR VARIABLE
D(4)=TEMP+J*1
RECALCULATE
C(2)=D(4)*D(10)+1)**D(11)*D(10)+D(12)*D(10)+1)**D(11)
call SUBDI(C,D)
PRINT A LINE OF OUTPUT
WRITE(6,601) I,D(4),(D(JJ),JJ=1,8)
601 FORMAT(' ',I3,F14.4,26X,8F9.4)
201 CONTINUE
RESET TO ORIGINAL VALUES
D(4)=TEMP
C(2)=TEMP1
RETURN
END
SUBROUTINE RNG2(C,D,D,INDEX)
DIMENSION C(10),D(14),D(68)
TEMP=D(INDEX)
TEMP1=C(1)
TEMP2=C(2)
TEMP3=C(3)
DO 203 J=5,15
I=J*10
D(INDEX) = TEMP*J*1
C(1) = C3(D)
C(2) = D(4)*(D(10)+1)**D(11)*D(10)+D(12)*(D(10)+1)**D(11)
C(3) = D(15)*(D(10)+1)**D(11)*D(10)
CALL SUBDIC(DI)
WRITE(6,602) 1, D(INDEX), (DI(JJ), JJ=1,8)

602 FORMAT(' ', I13, E10.4, 3X, 8F9.4)

203 CONTINUE:
D(INDEX) = TEMP
C(1) = TEMP1
C(2) = TEMP2
C(3) = TEMP3
RETURN
END

***********************************************************************************************************************************************
SUBROUTINE RNG5(C, DI, D, MQ, INDEX)
IMPLICIT REAL*4 (A-Z)
DIMENSION C(10), DI(14), D(68)
TEMP = D(INDEX)
TEMP1 = D(13)
TEMP2 = C(4)
TEMP3 = C(6)
DO TO3 J = 5, 15
    I = J + 10
    D(INDEX) = TEMP*J*1
    IF (INDEX.EQ.27) GO TO 640
    D(13) = TEMP1*J*1
    GO TO 641
640 D(13) = D(26)*D(27)*D(28)*D(29)
641 C(4) = D(13)+D(14)/2.
    C(6) = 0.0
    IF (D(30)*D(31).NE.0) C(6) = (2*D(25)*D(29)*D(26)*D(28))*MQ*D(27)/
    L(D(30)*D(31))
    C(7) = C(6)+C(5)/2.
    C(9) = D(13)
CALL SUBD(C,DI)
IF(INDEX.EQ.27) GO TO 642
WRITE(6,621) I,D(13),D(29),(DI(JJ),JJ=1,8)
GO TO 703
642 WRITE(6,621) I,D(27),D(13),(DI(JJ),JJ=1,8)
621 FORMAT(* *,I3,2F13.4,14X,8F9.4)
703 CONTINUE
D(INDEX)=TEMP
D(13)=TEMP1
C(4)=TEMP2
C(6)=TEMP3
C(7)=C(6)+C(5)/2.
C(9)=D(13)
RETURN
END

*******************************************************************************
*******************************************************************************
SUBROUTINE RNG6(C,DI,D,MS,IND1,IND2)
IMPLICIT REAL*4 (A-H,K-Z)
DIMENSION C(10),DI(14),D(68)
TEMP=D(IND1)
TEMP1=D(IND2)
TEMP2=D(14)
TEMP3=C(4)
TEMP4=C(5)
DO 304 J=5,15
I=J*10
D(IND1)=TEMP*J*.1
D(IND2)=TEMP1*J*.1
D(14)=TEMP2*J*.1
C(4)=D(13)+D(14)/2.
C(5)=0.*0
IF(D(38).NE.0) C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)
1*D(37)/D(38)*MS*4
C(7)=C(6)+C(5)/2.
C(10)=D(14)
CALL SUBD(C,DI)
IF(IND1.EQ.33) GO TO 671
WRITE(6,622) I,D(38),D(36),D(14), (DI(JJ),JJ=1,8)
GO TO 304
671 WRITE(6,622) I,D(14),D(33),D(34), (DI(JJ),JJ=1,8)
622 FORMAT(' ',I3,F13.4,F10.4,F13.4,4X,8F9.4)
304 CONTINUE
D(IND1)=TEMP
D(IND2)=TEMP1
D(14)=TEMP2
C(4)=TEMP3
C(5)=TEMP4
C(7)=C(6)+C(5)/2.
C(10)=D(14)
RETURN
END
******************************************************************************
******************************************************************************
SUBROUTINE RNG7(C,DI,D)
DIMENSION C(10),DI(4),D(68)
TEMP=D(15)
TEMP1=C(3)
DO 306 J=5,15
 I=J*10
 D(15)=TEMP*J)*1
 C(3)=D(15)*(D(10)+1)**D(11)*D(10)
 CALL SUBD(C,DI)
 WRITE(6,604) I,D(15), (DI(JJ),JJ=1,8)
604 FORMAT(' ',I3,F14.4,26X,8F9.4)
306 CONTINUE
D(15)=TEMP
C(3)=TEMP1
RETURN
END
******************************************************************************
******************************************************************************
SUBROUTINE RNG8(C, DI, D, INDEX)
DIMENSION C(10), DI(14), D(68)
TEMP = D(INDEX)
TEMP1 = C(1)
DO 308 J = 5, 15
I = J*10
D(INDEX) = TEMP*J*.1
C(1) = C3(D)
CALL SUBD(C, DI)
WRITE(6, 605) I, D(INDEX), (DI(JJ), JJ = 1, 8)
605 FORMAT( ' ' , I3, F12.4, 28X, 8F9.4 )
308 CONTINUE
D(INDEX) = TEMP
C(I) = TEMP1
RETURN
END

C *******************************************************************
C *******************************************************************
SUBROUTINE RNG12(C, DI, D)
DIMENSION C(10), DI(14), D(68)
DO 310 J = 5, 15
I = J*10
C(I) = D(24)*J*.1
CALL SUBD(C, DI)
WRITE(6, 606) I, C(I), (DI(JJ), JJ = 1, 8)
606 FORMAT( ' ' , I3, F10.4, 30X, F9.4 )
310 CONTINUE
C(I) = D(24)
RETURN
END

C *******************************************************************
C *******************************************************************
SUBROUTINE RNG13(C, DI, D, MQ, INDEX)
IMPLICIT REAL*4 (A-H, K-Z)
DIMENSION C(10), DI(14), D(68)
TEMP = D(INDEX)
TEMP1=C(6)
DO 312 J=5,15
I=J*10
D(INDEX)=TEMP*J*1
C(6)=0.0
IF(D(30)*D(31).NE.0)C(6)=(2*D(25)*D(29)*D(26)*D(28))*MQ*D(27)/
I(D(30)*D(31))
C(7)=C(6)+C(5)/2.
CALL SUBD(C,DI)
WRITE(*,607) I,D(INDEX),(DI(JJ),JJ=1,8)
607 FORMAT(*,13,I3,F10.4,30X,8F9.4)
312 CONTINUE
D(INDEX)=TEMP
C(6)=TEMP1
C(7)=C(6)+C(5)/2.
RETURN
END

*******************************************************************
*******************************************************************
SUBROUTINE RNG19B(C,DI,D,MQ)
IMPLICIT REAL*4 (A-H,K-Z)
DIMENSION C(10),DI(14),D(68)
INDEX=31
TEMP=D(INDEX)
TEMP1=D(27)
TEMP2=D(13)
TEMP3=C(4)
TEMP4=C(6)
DO 709 J=5,15
I=J*10
D(INDEX)=TEMP*J*1
D(27)=TEMP1*J*1
D(13)=D(26)*D(27)*D(28)*D(29)
C(4)=D(13)+D(14)/2.
C(6)=0.0
IF(D(30)*D(31).NE.0)C(6)=(2*D(25)*D(29)*D(26)*D(28))*MQ*D(27)/
**%**+**++*********************************************************
**%**+**++*********************************************************
**%**+**++*********************************************************

```fortran
WRITE(6,625) I,D(INDEX),D(14),(DI(JJ),JJ=1,8)
625 FORMAT(13,F10.4,F13.4,17X,8F9.4)
711 CONTINUE
   D(INDEX)=TFMP
   D(14)=TEMPI
   C(4)=TEMP2
   C(5)=TEMP3
   C(7)=C(6)+C(5)/2
   C(10)=D(14)
RETURN
END

*******************************************************************

C SUBROUTINE RNG23(C,DI,D,MS)
IMPLICIT REAL*4 (A-H,K-Z)
DIMENSION C(66),CI(16)
INDEX=35
TEMP=D(INDEX)
TEMPI=C(5)
DO 713 J = 5,15
   I=J*10
   D(INDEX)=TEMP*J+I
   C(5)=0.0
   IF(D(38).NE.0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))/D(36)
   C(7)=C(6)+C(5)/2.
   CALL SUBO(C,DI)
WRITE(6,610) I,D(INDEX),(DI(JJ),JJ=1,8)
610 FORMAT(13,F10.4,30X,8F9.4)
713 CONTINUE
   D(INDEX)=TEMP
   C(5)=TEMPI
   C(7)=C(6)+C(5)/2.
RETURN
END

*******************************************************************
```

C SUBROUTINE RNG23(C,DI,D,MS)
IMPLICIT REAL*4 (A-H,K-Z)
DIMENSION C(66),CI(16)
INDEX=35
TEMP=D(INDEX)
TEMPI=C(5)
DO 713 J = 5,15
   I=J*10
   D(INDEX)=TEMP*J+I
   C(5)=0.0
   IF(D(38).NE.0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))/D(36)
   C(7)=C(6)+C(5)/2.
   CALL SUBO(C,DI)
WRITE(6,610) I,D(INDEX),(DI(JJ),JJ=1,8)
610 FORMAT(13,F10.4,30X,8F9.4)
713 CONTINUE
   D(INDEX)=TEMP
   C(5)=TEMPI
   C(7)=C(6)+C(5)/2.
RETURN
END

*******************************************************************
SUBROUTINE RN26B(C, DI, D, MS)
IMPLICIT REAL*4 (A-H, K-Z)
DIMENSION D(68), C(10), DI(16)
INDEX=38
TEMP=D(INDEX)
TEMP1=D(33)
TEMP2=D(34)
TEMP3=D(36)
TEMP4=C(5)
DO 721 J = 1, 15
I=J*10
D(INDEX)=TEMP*J**10
D(33)=TEMP1/(J**1)
D(34)=TEMP2/(J**1)
D(36)=TEMP3*J**1
C(5)=0.0
IF(D(38).NE.0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))**D(36)
1/D(37)/D(38)*MS**4
C(7)=C(6)+C(5)/2.
CALL SUBD(C, DI)
WRITE(6, 629) I, D(INDEX), D(36), D(33), D(34), (DI(JJ), JJ=1, 8)
629 FORMAT( ' ', I3, 4F10.4, 8F9.4)
721 CONTINUE
D(INDEX)=TEMP
D(33)=TEMP1
D(34)=TEMP2
D(36)=TEMP3
C(5)=TEMP4
C(7)=C(6)+C(5)/2.
RETURN
END

SUBROUTINE RNGMS(C, DI, D, MS)
IMPLICIT REAL*4 (A-H, K-Z)

C
*****************************************************************************
SUBROUTINE RN26B(C, DI, D, MS)
IMPLICIT REAL*4 (A-H, K-Z)
DIMENSION D(68), C(10), DI(16)
INDEX=38
TEMP=D(INDEX)
TEMP1=D(33)
TEMP2=D(34)
TEMP3=D(36)
TEMP4=C(5)
DO 721 J = 1, 15
I=J*10
D(INDEX)=TEMP*J**10
D(33)=TEMP1/(J**1)
D(34)=TEMP2/(J**1)
D(36)=TEMP3*J**1
C(5)=0.0
IF(D(38).NE.0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))**D(36)
1/D(37)/D(38)*MS**4
C(7)=C(6)+C(5)/2.
CALL SUBD(C, DI)
WRITE(6, 629) I, D(INDEX), D(36), D(33), D(34), (DI(JJ), JJ=1, 8)
629 FORMAT( ' ', I3, 4F10.4, 8F9.4)
721 CONTINUE
D(INDEX)=TEMP
D(33)=TEMP1
D(34)=TEMP2
D(36)=TEMP3
C(5)=TEMP4
C(7)=C(6)+C(5)/2.
RETURN
END

C
*****************************************************************************
SUBROUTINE RNGMS(C, DI, D, MS)
IMPLICIT REAL*4 (A-H, K-Z)
DIMENSION D(68), C(10), DI(16)
TEMP1=C(5)
DO 723 J=5,15
I=J*10
M=MQ*J*1
C(5)=0.0
IF(D(30)*D(31).NE.0) C(6)=(2*D(25)*D(29)*D(26)*D(28)).*M*D(27)/
(2*D(30)*D(31))
C(7)=C(6)+C(5)/2.
CALL SUBD(C,DI)
WRITE(6,488) I,M,(DI(JJ),JJ=1,8)
488 FORMAT(' ',I3,F10.4,30X,8F9.4)
723 CONTINUE
C(6)=TEMP1
C(7)=C(6)+C(5)/2.
RETURN
END

SUBROUTINE RNGMQ(C, DI, D, MQ)
IMPLICIT REAL*4 (A-H,K-Z)
DIMENSION D(68), C(10), DI(16)
TEMP1=C(6)
DO 725 J=5,15
I=J*10
M=MQ*J*1
C(6)=0.0
IF(D(30)*D(31).NE.0) C(6)=(2*D(25)*D(29)*D(26)*D(28)).*M*D(27)/
(2*D(30)*D(31))
C(7)=C(6)+C(5)/2.
CALL SUBD(C,DI)
WRITE(6,488) I,M,(DI(JJ),JJ=1,8)
488 FORMAT(' ',I3,F10.4,30X,8F9.4)
725 CONTINUE
C(6)=TEMP1
C(7)=C(6)+C(5)/2.
The Payoff Program was also written to be run with a single deck of data cards. By applying a standard change of 10% to each variable of the model, comparisons are achieved between the relative sensitivity of these variables in affecting output values. Comparisons are presented, as shown in Table 10 and Figure 15 in Chapter VIII. Table 10 is a somewhat abbreviated form of the printout as received from the computer. Computer time averaged 0.8 seconds per plan (one data deck) for comparisons of 21 variables.
THIS PROGRAM IS DESIGNED TO COMPARE THE SENSITIVITY OF THE INPUT VARIABLES

THIS PROGRAM COMPUTES THE COST FACTORS FROM THE INPUT DATA. IT THEN TAKES EACH VARIABLE AND SETS IT TO 110 PERCENT OF ITS INPUT VALUE. THEN IT RECALCULATES THE COST FACTORS AND COMPUTES THE PERCENTAGE DIFFERENCES WHICH ARE SUBSEQUENTLY PRINTED.

ARRAY D CONTAINS ALL INFORMATION READ OFF THE CARDS WITH THE EXCEPTION OF THE NUMERIC ID CODE WHICH IS STORED IN ARRAY ICODE. ARRAY C CONTAINS RESULTS OF SIDE CALCULATIONS. ARRAYS THE DI AND DJ STORE THE COST FACTORS FOR 100 PERCENT AND 110 PERCENT OF THE INPUT VALUES. ARRAY PERC STORES THE PERCENTAGE DIFFERENCE BETWEEN DI AND DJ.

IMPLICIT REAL*4 (A-H,K-Z)
DIMENSION D(68),C(10),DI(9),DJ(9),ICODE(3),PERC(9)

IND IS AN INDICATOR TO SHOW WHEN THE END OF DATA IS REACHED:

IND=0

THIS SUBROUTINE READS IN THE DATA:

CALL INPUT(D,IND,ICODE)

WHEN THE DATA IS EXHAUSTED PROGRAM TERMINATES:

IF(IND.EQ.3) STOP

THIS CALCULATES THE AVERAGE DISTANCE FOR ALL CAMPERS AND D-V
MS = 0.0
MO = 0.0
DO 21 J = 1, 10
  21 M0 = MO + D(37 + 2 * J) * D(38 + 2 * J)
DO 22 J = 1, 5
  22 MS = MS + D(57 + 2 * J) * D(58 + 2 * J)
C THE FOLLOWING, C(1) - C(10), ARE USED AS SUBCALCULATIONS IN REACHING
C VALUES FOR COSTS (DJ)
C(1) = C3(D)
C(2) = D(4) * (D(10) + 1) ** D(11) * D(10) + D(12) * (D(10) + 1) ** D(11)
C(3) = D(15) * (D(10) + 1) ** D(11) * D(10)
C(4) = D(13) * D(14) / 2.
C(5) = 0.0
IF (D(38) .NE. 0) C(5) = D(35) * (D(32) * D(33) + (D(28) - D(32)) * D(34)) * D(36)
1 * D(37) / D(38) * MS * 4
C(6) = 0.0
1(D(30) * D(31))
C(7) = C(6) + C(5) / 2.
C(8) = D(24)
C(9) = D(13)
C(10) = D(14)
C_dice
c THIS SUBROUTINE CALCULATES VALUES SEEN ON THE FIRST PAGE OF OUTPUT
C THIS SUBROUTINE PRINTS THE IDENTIFICATION OF THE PARTICULAR DATA SET
C AND THE COST VALUES OBTAINED FROM THE INPUT VALUES
C THIS SUBROUTINE PRINTS THE IDENTIFICATION OF THE PARTICULAR DATA SET
C AND THE COST VALUES OBTAINED FROM THE INPUT VALUES
C CALL SUBRD(D, DJ)
C CALL PRINT2(D, DJ, MS, MO, ICODE)
C C_dice
C MOVES TO NEW PAGE
WRITE(6, 899)
899 FORMAT('1')
C PRINTS TABLE HEADING
WRITE(6, 222)
222 FORMAT(' THE FOLLOWING TABLE GIVES THE PERCENTAGE CHANGES IN D VAL
UTES FOR A ', '/', ' 101 INCREASE IN THE FIRST VARIABLE LISTED AND', '/',)
2' CORRESPONDING CHANGES IN THE OTHER VARIABLES LISTED'
WRITE(6,333)
333 FORMAT(' ',35X,' OF D1',25X,' PERCENTAGES',/,' AFFECTED V
1VALUE OF TERMS IN AFFECTED',3X,68('**''),/,' VARIABLES FIRS
2T VAR. AFFECTED TERMS ',3X,'D1',6X,'D2',6X,'D3',6X,'D4',6X,
3'D5',6X,'D6',6X,'D7',6X,'D8',6X,'D9',6X,'D1-D6')
C ********************************
C CALCULATES THE PERCENTAGE OF D1 AFFECTED WHEN CERTAIN VARIABLES
ARE CHANGED
P1=DJ(2)/DJ(1)*100.0
P2=(DJ(2)+DJ(3)+DJ(4))/DJ(1)*100.0
P3=DJ(3)/DJ(1)*100.0
P4=DJ(5)/DJ(1)*100.0
P5=DJ(6)/DJ(1)*100.0
P6=100.0
C STORE VALUES SO THEY CAN BE RESET LATER
TEMP4=C(4)
TEMP5=C(5)
TEMP6=C(6)
TEMP7=C(7)
TEMP8=C(8)
TEMP9=C(9)
TEMP10=C(10)
TEMP11=C(11)
TEMP12=C(2)
TEMP13=C(3)
C ***************************************************************
C THE CALCULATIONS FOR THE FIRST LINE OF THE TABLE BEGIN HERE
C ***************************************************************
C STORE ORIGINAL VALUE
TEMP=D(4)
C SET VARIABLE TO 110( OF ITS INPUT VALUE
D(4)=TEMP*1.1
C AFFECTED SUBCALCULATIONS ARE REFERRED
C(2)=D(4)*(D(10)+1)**D(11)*D(10)*D(12)*(D(10)+1)**D(11)
C SUBROUTINE GO FINISHES CALCULATIONS ARE PRINTS THE RESULTS
CALL GO(C,D)
C RESET VARIABLES
D(4)=TEMP
C PRINTS LINE HEADING ON SAME LINE THAT WAS PRINTED IN "GO"
WRITE(6,101) D(4),P1
101 FORMAT(' ',D15.4,' ',D2,' ',F6.1,'(')
C ***********************************************
C CALCULATIONS FOR NEW LINE BEGIN HERE
C THE SAME GENERAL FORM IS USED ON THE INSTRUCTIONS THAT FOLLOW AS
C WAS USED ON THE PREVIOUS SIX INSTRUCTIONS
C ***********************************************
TEMP=D(10)
D(10)=TEMP*1.1
C(1)=C3(D)
C(2)=D(4)*(D(10)+1)**D(11)*D(10)+D(12)*(D(10)+1)**D(11)
C(3)=D(15)*(D(10)+1)**D(11)*D(10)
CALL GO(C,D)
D(10)=TEMP
WRITE(6,102) D(10),P2
102 FORMAT(' ',D15.4,' ',D2,D3,D4,' ',F6.1,'(')
C ***********************************************
TEMP=D(11)
D(11)=TEMP*1.1
C(1)=C3(D)
C(2)=D(4)*(D(10)+1)**D(11)*D(10)+D(12)*(D(10)+1)**D(11)
C(3)=D(15)*(D(10)+1)**D(11)*D(10)
CALL GO(C,D)
D(11)=TEMP
C(1)=TEMP11
C(2)=TEMP12
C(3)=TEMP13
WRITE(6,103) D(11),P2
103 FORMAT(' ',D15.4,' ',D2,D3,D4,' ',F6.1,'(')
C ***********************************************
TEMP=D(29)
TEMP1=D(13)
<table>
<thead>
<tr>
<th>C</th>
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<tbody>
<tr>
<td><strong>III FORMAT (6,110,130,91</strong></td>
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</tr>
<tr>
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</table>
D(31)=TEMP*1.1
D(77)=TEMP1*1.1
D(13)=D(26)*D(27)*D(28)*D(29)
C(4)=D(13)+D(14)/2
C(61)=0.0
IF(D(30)*D(31)>0) C(6)=(2*D(25)*D(29)*D(26)*D(28))**MQ*D(27) /
1(D(30)*D(31))
C(7)=C(6)+C(5)/2
C(9)=D(13)
CALL GO(C,0J)
D(31)=TEMP
D(27)=TEMP1
D(13)=TEMP2
L(6)=TEMP6
L(9)=TEMP9
WRITE(6,112) D(31),P6
112 FORMAT(12P+4G15.4,' ALL,D7','F6.1,'"')

C    ******************************************
    TEMP=D(32)
    TEMP1=D(14)
    D(32)=TEMP*1.1
    D(14)=(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)*D(37)
    C(4)=D(13)+D(14)/2,
    C(5)=0.0
    IF((D(38),NE.0)) C(5)=(D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)/D(37))
    1*D(37)/D(38)*MS*4
    C(7)=C(6)+C(5)/2
    C(10)=D(14)
    CALL GO(C,OJ)
    D(37)=TEMP
    WRITE(6,113) D(32),P6
113 FORMAT(12P+4H15.4,' ALL,D8','F6.1,'"')
C    ******************************************
    TEMP=D(33)
    D(33)=TEMP*1.1
    D(14)=(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)*D(37)
C(4)=D(13)+D(14)/2.
C(5)=0.0
IF(D(38),NE,0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)
1*D(37)/D(38)*MS*4
C(7)=C(6)+C(5)/2
C(10)=D(14)
CALL GO(C,DJ)
D(33)=TEMP
WRITE(6,114) D(33),P6
114 FORMAT('W1+H','F15.4','ALL,D8','F6.1(','')
C
***********************************************************************************************
TEMP=D(34)
D(34)=TEMP*1.1
D(14)=(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)*D(37)
C(4)=D(13)+D(14)/2.
C(5)=0.0
IF(D(39),NE,0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)
1*D(37)/D(38)*MS*4
C(7)=C(6)+C(5)/2
C(10)=D(14)
CALL GO(C,DJ)
D(34)=TEMP
D(14)=TEMP1
C(4)=TEMP4
C(10)=TEMP10
WRITE(6,115) D(34),P6
115 FORMAT('W2+H','F15.4','ALL,D8','F6.1(','')
C
***************************************************************************
TEMP=D(35)
D(35)=TEMP*1.1
C(5)=0.0
IF(D(38),NE,0)C(5)=D(35)*(D(32)*D(33)+(D(28)-D(32))*D(34))*D(36)
1*D(37)/D(38)*MS*4
C(7)=C(6)+C(5)/2
CALL GO(C,DJ)
D(35)=TEMP
WRITE(6,116) D(35), P5

116 FORMAT(* K1 ', F15.4, ' D6, D8 ', F6.1, '*')

C ********************************************************************
C Tempo = D(37)
C D(37) = Tempo * 1.1
C D(14) = (D(32) * D(33) + (D(28) - D(32)) * D(34)) * D(36) * D(37)
C C(4) = D(13) + D(14) / 2.
C C(5) = 0.0
C IF(D(38) .NE. 0) C(5) = D(35) * (D(32) * D(33) + (D(28) - D(32)) * D(34)) * D(36)
1* D(37) / D(38) * MS*4
C C(7) = C(6) + C(5) / 2
C C(10) = D(14)
C CALL GO(C, DJ)
D(37) = Tempo
WRITE(6,117) D(37), P6

117 FORMAT(* T+H ', F15.4, ' ALL, D8 ', F6.1, '*')

C ********************************************************************
C Tempo = D(36)
C Tempo2 = D(38)
C D(36) = Tempo * 1.1
C D(38) = Tempo2 * 1.1
C D(14) = Tempo1 * 1.1
C C(4) = D(13) + D(14) / 2.
C C(5) = 0.0
C IF(D(38) .NE. 0) C(5) = D(35) * (D(32) * D(33) + (D(28) - D(32)) * D(34)) * D(36)
1* D(37) / D(38) * MS*4
C C(7) = C(6) + C(5) / 2
C C(10) = D(14)
C CALL GO(C, DJ)
D(14) = Tempo1
C C(4) = Tempo4
C C(10) = Tempo10
WRITE(6,118) Tempo, ': ', P6

118 FORMAT(* P1+X1+H ', F15.4, ' ALL, D8 ', F6.1, '*')

C ********************************************************************
C Tempo1 = D(33)
TEMP3 = D(34)
D(38) = TEMP2 * D(1)
D(39) = TEMP1 / D(1)
D(36) = TEMP3 / D(1)
C(51) = 0.0

IF (D(38) .NE. 0) C(5) = D(35) * (D(32) * D(33) + (D(28) - D(32)) * D(34)) * D(36)
1 * D(37) / D(38) * MS * 4
C(7) = C(6) * C(5) / 2
CALL G0(C, D, J)
D(26) = TEMP2
D(33) = TEMP1
D(34) = TEMP3
WRITE (6, 119) D(38), P5
119 FORMAT('P1X1W1W2', 'F15.4', 'D6,D8', F6.1, '(', ')
C

IF (D(38) .LT. 0) C(5) = D(35) * (D(32) * D(33) + (D(28) - D(32)) * D(34)) * D(36)
1 * D(37) / D(38) * MS * 4
C(7) = C(6) * C(5) / 2
CALL G0(C, D, J)
C
MS = TEMP
WRITE (6, 120) MS, P5
120 FORMAT('P1X1W1W2', 'F15.4', 'D6,D8', F6.1, '(', ')
C

IF (D(30) * D(31) .LT. 0) C(6) = (2 * D(25) * D(29) * D(26) * D(28)) * MQ * D(27) / 
1 (D(30) * D(31))
C(7) = C(6) * C(5) / 2
CALL G0(C, D, J)
MO=TEMP
C(6)=TEMP6
C(7)=TEMP7
WRITE(6,121) MO,P5
121 FORMAT('MO',F15.4,'D6,D7',F6.1,'D')
C
RETURN TO START
GO TO 150
END
C
*******************************************************************
Q
*******************************************************************
Q
**************************************************************

SUBROUTINE INPUT(INO,ICODE)
DIMENSION DATA(6),ICODE(3)
C
READS FIRST VARIABLE AND ALL IDENTIFICATION INFORMATION
C
AT END OF DATA SET IND=3 RETURN TO MAIN WHERE PROGRAM IS TERMINATED
READ(5,2,END=13) ICODE,DATA(4),DATA(5),DATA(6),
1DATA(7),DATA(8),DATA(9)
2 FORMAT(T10.12,13,I1,T21,F10.0,T61,5A4)
C
FOLLOWING READS ALL SUBSEQUENT 40 CARDS IN SET
3 DO 5 J=10,15
4 FORMAT(T21,F10.0)
5 CONTINUE
DO 7 J=16,22,2
6 FORMAT(T19,F2.0,F10.0)
7 CONTINUE
DO 8 J=24,38
8 CONTINUE
DO 9 J=39,67,2
9 FORMAT(T21,F10.0,F10.0)
10 CONTINUE
RETURN
FUNCTION C3(D)
DIMENSION 0(68)
C=0.0
DO 20 J=1,4
IF(D(14+2*J).EQ.0.0) GO TO 19
S=(0(10)|t)**D(11)*D(10)*{(D(10)+1)**D(14+2*J)))/((D(10)+1)**D(14+2*J)-1)
C=C+D(15+2*J)*S
CONTINUE
C3 = C
RETURN
END

SUBROUTINE SUBOIC.OI)
DIMENSION C(D),DI(9)
THESE ARE THE COST FIGURES
DI(1)=(C(2)+C(3)+C(1)+C(8)+C(7))/C(4)
DI(2)=C(2)/C(4)
DI(3)=C(3)/C(4)
DI(4)=C(1)/C(4)
DI(5)=C(8)/C(4)
DI(6)=C(7)/C(4)
DI(7)=0.0
IF(C(9).NE.0) DI(7)=C(6)/C(9)
DI(8)=0.0
IF(C(10).NE.0) DI(8)=C(5)/C(10)
DI(9)=DI(1)-DI(6)
RETURN
END
C *******************************************************************
C yc ******************************** ***************** ****************
SUBROUTINE GO(C,DJ)
DIMENSION C(IO),DI(9),DJ(9),PERCNT(9)
C THIS SUBROUTINE GETS NEW COST FIGURES IN LIGHT OF CHANGE IN INPUT
C VALUES
CALL SUBD(C,DI)
CALL COMP(DJ,DI,PERCNT)
C PRINT LINE ON TABLE
WRITE(6,300) PERCNT
300 FORMAT(' 45X,9F8.2)
RETURN
C *******************************************************************
C yc ******************************** **********************************
SUBROUTINE COMP(DJ,DI,PERC)
DIMENSION DJ(9),DI(9),PERC(9)
C FIGURES PERCENTAGE DIFFERENCES IN COST FIGURES
DO 21 J=1,9
21 PERC(J)=(DI(J)-DJ(J))/DJ(J)*100.0
DO 620 J=7,8
IF(DJ(J).EQ.0) GO TO 625
PERC(J) = ((DI(J) - DJ(J)) / DJ(J)) * 100.0
GO TO 620
625 PERC(J) = 0.0
620 CONTINUE
J = 9
PERC(J) = ((DI(J) - DJ(J)) / DJ(J)) * 100.0
RETURN
END
Fig. 16 Washington planning regions and study sites