ECONOMICS OF WATER IN RECREATION DEVELOPMENT

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The least expected of the post World War II shortages was the supply of natural resources developed in part or entirely for recreational purposes. The serious outdoor recreational resource supply shortages of the early 1950's caught most resource planners looking the other way. However, early efforts by a few focused attention on the problem. Later, a congressional commission was formed, succeeded shortly by a federal bureau, a multiplicity of state agencies and an awakened press. By the late 1950's, the recreational boom and research bandwagon were picking up speed.

Numerous statistics are available that project our recreational needs for the future. Perhaps the most quoted of these are the consumption estimates developed by the Outdoor Recreation Resources Review Commission (1), Figure 1.

Note the types of recreation that are expected to exceed 500 million occasions each by the year 2000--swimming, driving, outdoor games, walking, sightseeing, picnicking, boating and fishing. In the total of over 12 billion outdoor summer recreation occasions in the United States by 2000, water is a strategic resource in three of the eight major activities, a major element in three others, and perhaps of minor importance in the final two activities--driving and walking.

On what basis were these estimates made of outdoor recreational use 30 to 50 years hence? The estimates are based on a combination of at least four major factors (2). These factors and their combined effects are pictured in Figure 2. Note the accumulation effect of each factor.

New Mexico is expected to participate at least partially in the recreation boom. The extent to which we will share in the benefits are not known except in a general way. However, some projections of the expected number of recreationists are available for various parts of New Mexico. One projection for the Silver City Area is shown in Figure 3 (3).

Apparently projections beyond 1976 "frightened" these Forest Service planners because their projections ran off the desk after 1968.

As long as outdoor recreation in New Mexico is based on a mix of the natural resources rather than on one or two resources in short supply,

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FIGURE I: NUMBER OF OCCASIONS OF PARTICIPATION IN OUTDOOR SUMMER RECREATION--BY MILLIONS

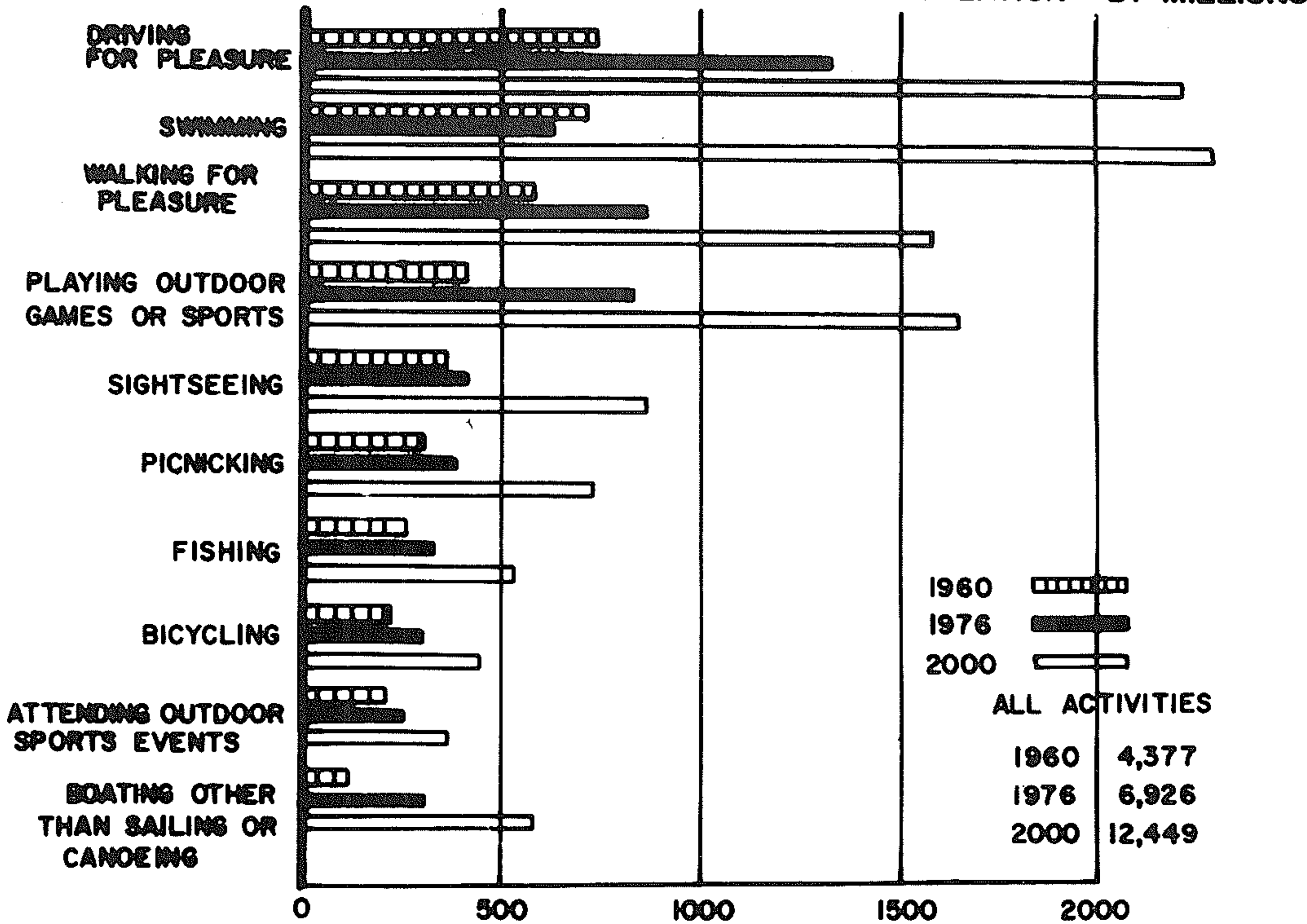


FIGURE 2.
FACTORS USED TO PREDICT FUTURE RECREATIONAL NEEDS IN THE UNITED STATES

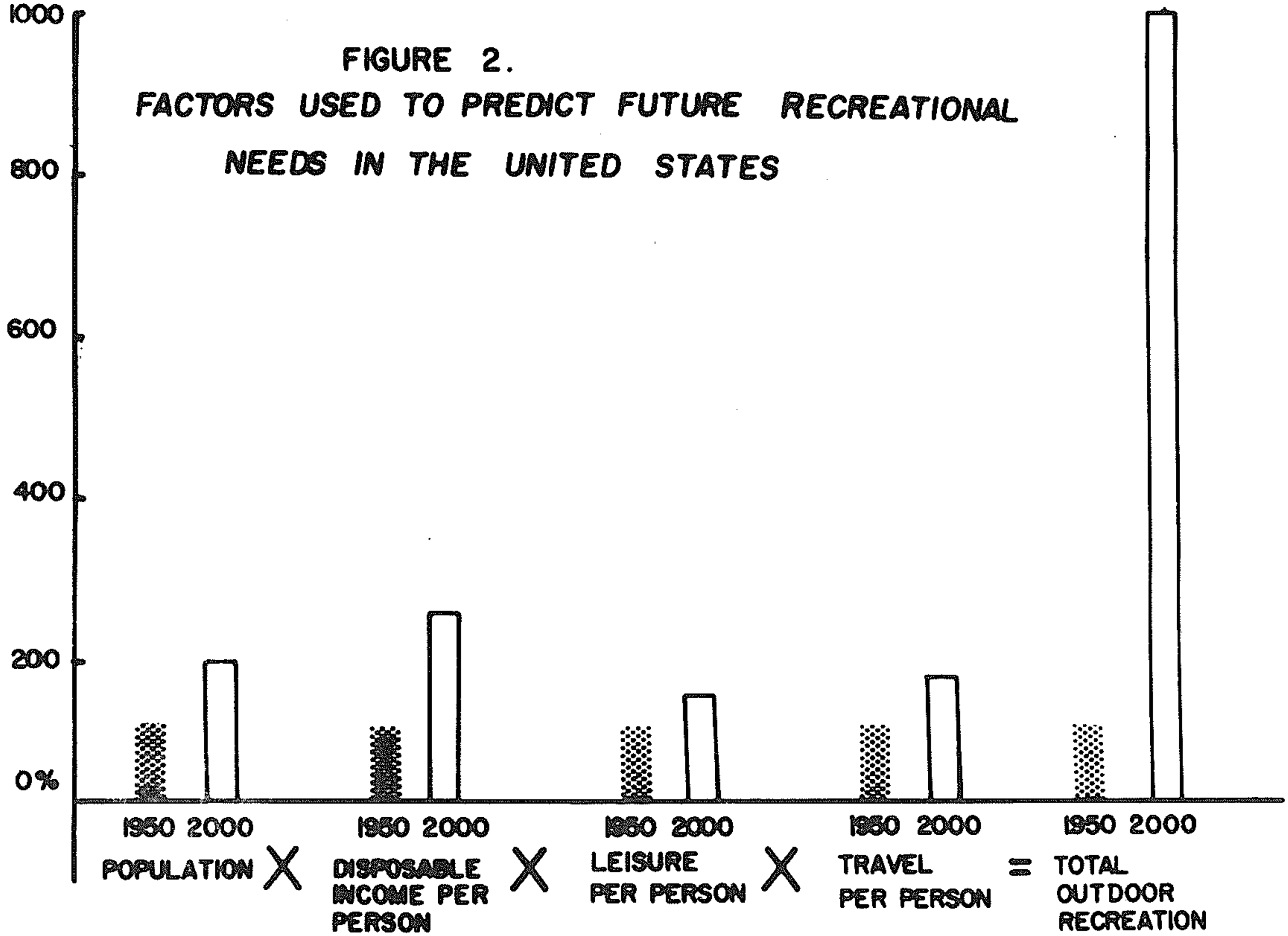
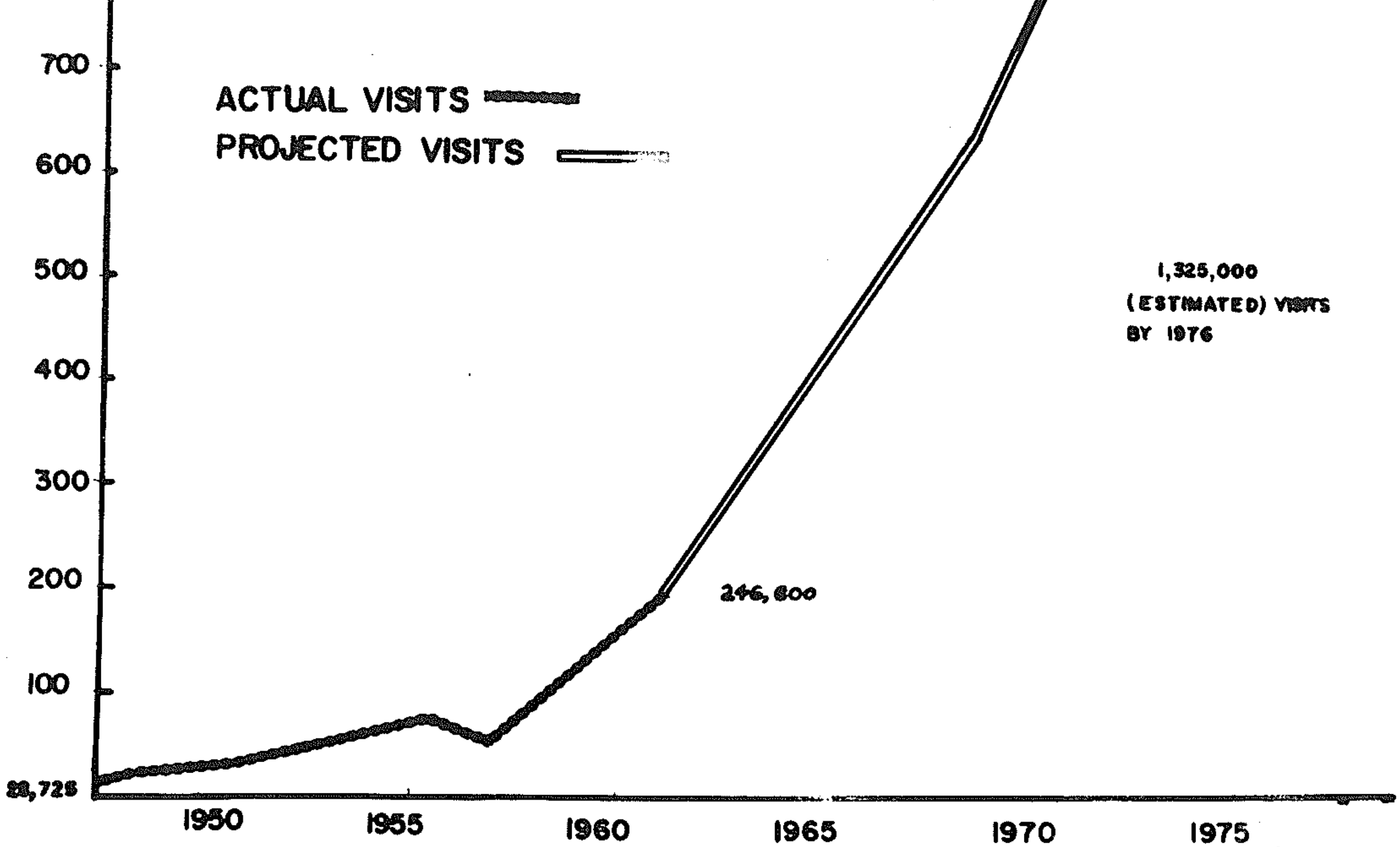


FIGURE 3.

GILA NATIONAL FOREST RECREATION VISITS



it might be expected that we can equal or exceed the U. S. projection. But if recreational needs fall heavily on one of our resources in short supply, such as water, we may be in trouble.

A review of various sources indicate that there are approximately 126,000 acres, or 200 square miles, of water surface in the major reservoirs, lakes and rivers in New Mexico. There is a maximum potential of 294 square miles. These amounts are much less than those of any of the other 17 western states. A state with a single lake or reservoir that is 30 miles long by 10 miles wide, or any similar combination of sizes, would have more water surface than the maximum for the entire State of New Mexico. Since water is an essential ingredient in most types of outdoor recreation, water is expected to be our most limiting recreational resource. Presently, our one million residents are limited in their recreational pursuits of swimming, boating, water skiing, fishing and waterfowl hunting by this restricted water surface. If the state's maximum water surfaces were gathered together into the one body of water as represented by a 30-mile-long lake, and if all of the state's population decided to go swimming at one time in this lake, there would be a 5-inch strip of water for each bather. Most of us need at least a foot, and judging by apprearances, some of us might need two or three feet.

An overwhelming majority of the "large" (over 40 acres) water surfaces of the state is contained in four of its reservoirs, Elephant Butte, Navajo, McMillan and Conchas. These reservoirs were constructed mainly to provide irrigation water for agricultural purposes and for flood control. Recreation mainly is a secondary and supplementary use of whatever water happens to be impounded. Reservoir levels fluctuate widely from one season or year to the next, and it is speculated that this fluctuation greatly reduces their recreational values.

Because water is our recreational resource in most limited supply, then it behooves us to plan for and use this water as wisely as possible. To aid in this planning some of the techniques used in measuring the value of recreation to state and local economies should be understood. Knetsch feels that this is a major deficiency of recreational research efforts to date (4).

In this address several of the economic techniques that have been used to measure recreational values will be described. Some of the results of water-based recreational studies in various areas will be shown. Two studies completed in New Mexico will be presented in detail. And finally, the direction of future studies in recreational economics will be indicated.

METHODS OF MEASURING RECREATIONAL VALUES

There are about as many methods used to determine recreational values as there are economists in this research area. Perhaps a very brief review of some of them would be appropriate with the techniques described roughly in ascending order of complexity.

1. The Cost Method. This method uses the cost of providing, operating and maintaining recreational facilities as a direct measure of the benefits. Obviously this technique could grossly underestimate the value of the resource if the facilities are heavily used, as often happens. It might overestimate the value if the developed resource remains unused.

2. The Market Value Method uses either the fees charged at private resorts as the measure of benefits or the costs of the facility adjusted to price level changes if the facility is publicly-owned. Both variations underestimate the value of the resource being used because the fees and costs of the facility usually include only a part of user costs and benefits derived from the recreational resource.

3. The Gross National-, State- of Local Expenditure Method is an estimate of recreational values of resources based on all expenditures by recreationists using the resource. This technique, either on a nationwide, statewide or local basis usually overestimates the value of the resource because expenditures are included that consumers would have made whether or not they engaged in a recreational activity. The four essentials of life are food, clothing, shelter, and recreation. The expenditure method includes the costs of all of these essentials rather than just the additional amounts occurring because of a recreational activity.

4. The Value-Added Method is one that subtracts from gross expenditures the costs of goods and services supplied to recreationists. Several difficulties are encountered that tend to lower the accuracy of this method. Besides the overestimation of value based on gross expenditures, the costs of many goods and services have been approximated, especially when the goods and services are supplied by persons employed by public agencies using resources in public ownership.

5. The Consumer Surplus Method has many variations. Three of the more commonly-used variations are:

a. The Trice-Wood Method uses as a value of recreation the difference between median travel expense per visitor-day and the travel expense below which 90 percent of the visitor-day travel expenses are found. In other words, the value of recreation is based roughly on the travel expenses of the 10 percent of the recreationists spending the largest amounts per visitor-day. In an area with many recreational developments and a high level of competition between areas, perhaps this method may be helpful. However, the difficulties include an arbitrary selection of the 90 percent level, an unresolved problem of accumulating expenses other than travel without which the value of the resource for recreation is grossly underestimated.

b. The <u>Concentric Travel Zone Method</u> uses as the value of recreation the difference between the weighted average of travel costs to the recreational resource being valued and the travel cost to sites in more distant zones. The major difficulty again is the inclusion of the single expense of travel cost, resulting in an artificially low value. This technique has, with modifications, been adapted and included in more modern techniques.

c. The <u>Travel Cost-Saving Method</u> utilizes the saving in the cost of travel resulting from using one site vs. the cost of using an alternative site. Again only travel costs are used to estimate recreational values, meaning an underestimation of value. This technique also has been useful in developing later models.

5. The <u>Demand Curve Method</u> was developed by Clawson and others and most economists are now using a variety of his method in estimating recreational values (5). In this method a demand curve is computed based on expenditures of different groups of recreationists living at varying distances from the recreational site. The X-axis, or independent variable, is usually expressed as the number of persons using the site per 100,000 of population in the recreationists' home areas. Clawson then combined the demand method with the concentric travel zone and travel cost-saving methods to determine the differences in the two demand curves (the site being studied and a competitive site) as representing the value of the recreational resource.

6. The <u>Monopoly Method</u>. Brown, Singh and Castle used a variation of the Demand Curve Method to estimate the value of salmon and steelhead fishing in Oregon (6). The variation used by these authors was to estimate net economic value of the resource by including a time cost factor, which they label as a "transfer cost." The transfer cost is based somewhat on the concentric travel zone and demand curve methods. Since time is an important factor in most recreationists' vacation plans, this is a reasonable addition. Also these authors distinguished between fixed (durable) and variable costs and used the variable cost category to determine marginal costs. Their net economic value is "their best estimate" of the monetary value which might exist if the resource were owned by a single individual, and a market existed for the opportunity to fish. The reasoning can be reduced to the amount that an owner would be able to charge anglers for the fishing experience. The price is that charged which would maximize the income of the monopolist, with price based on the demand curve of the recreationists. The difficulty with this method, other than its complexity,

is that the net value cannot be compared with alternative uses in a competitive situation. These authors recognized the limitations of their method.

7. The Wennergren Method (for want of a better designation) was devised to determine the value of water resources when they are used for boating (7). Demand curves were constructed based on travel costs plus expenditures at the site. Fixed (durable) and variable costs were determined. The "price" was assumed to be the travel plus on-site costs. The variable used as quantities is the number of trips made by each boater to the site. This quantity is then combined with the "price" to determine value. It was hypothesized that a boater will maximize his satisfaction in boating by equating his costs of repeated boat trips with the value of his satisfaction in boating. One with a low satisfaction will visit the site once. One with a high satisfaction will make repeated trips to the site.

The Wennergren Method leans heavily upon Clawson's demand curve method. Wennergren differs in that he estimates the surplus value, or the difference between the amounts that each of the various boaters paid and the amounts paid by all other boaters who had higher expenses. Boaters near the recreation site pay less than those living at distant points. The difference is accumulated and represents the value of water for boating purposes.

In New Mexico we have used two varieties of methods based partially on those previously mentioned, but unique in themselves. We used a simple demand curve analysis in a low budget study of the Ruidoso Area, utilizing a portion of the surplus value concept as conceived later by Wennergren (8). However, we relied heavily upon simple demand curves. Our study was based on the recreational expenditures of a sample of recreationists, with expenditures limited to those costs above the usual living costs had the recreationists chosen to stay at home. We included travel costs, on-site costs and fixed costs. We estimated the total surplus value of recreationists by simply computing the area under the demand curve. We divided recreationists into local and non-local groups (to permit some isolation of where expenditures might occur) and we tested our demand curves by determining both actual and maximum expenditures. Once recreational values were determined, we then included our result in a static linear programming model along with several kinds of competing uses and with several kinds of resources (9).

Left unanswered except in a general way in the Ruidoso study was the impact that recreationists made on local businesses. To solve this unknown area of recreation economics, we adapted the input-output model to small areas and added a recreational activity for the Reserve Area in west-central New Mexico (10). Briefly, the input-output model as we used it in a compilation of the total value of production of each business in the Reserve Area as well as the total value of products and services sold into the area that were produced elsewhere (final demand) which together are the total outputs of the area. The total value of goods and services used by businesses in the area as well as the value of goods and services imported together are the total inputs. Inputs and outputs are separated among the various groups found in the area. The dependency of each business on each of the other businesses is shown on a flow sheet with dependency being expressed in total dollar amounts.

Using Forest Service estimates of the numbers of recreationists expected when a recreational development is made, the output and inputs change as more recreationists visit the area. The change is considered to be the value of the recreational development.

RESULTS OF ECONOMIC STUDIES IN OTHER AREAS

The results of the study by Brown et al. (6) and Wennergren (7) are interesting because they use the more modern techniques of measuring recreational values, both studies deal with a popular resource use, and water is a strategic resource in the analyses.

The Oregon study indicated that salmon-steelhead sport anglers spent over $9 million annually for durable items (fixed costs) and over $8 million for current expenses (variable costs). The gross value was estimated as $18 million per year. Net economic value, or the estimated value of the resource to a single monopoly owner was estimated at from $2.5 to $3.1 million per year. Projections to 1972 indicated a net value of $4.7 million.

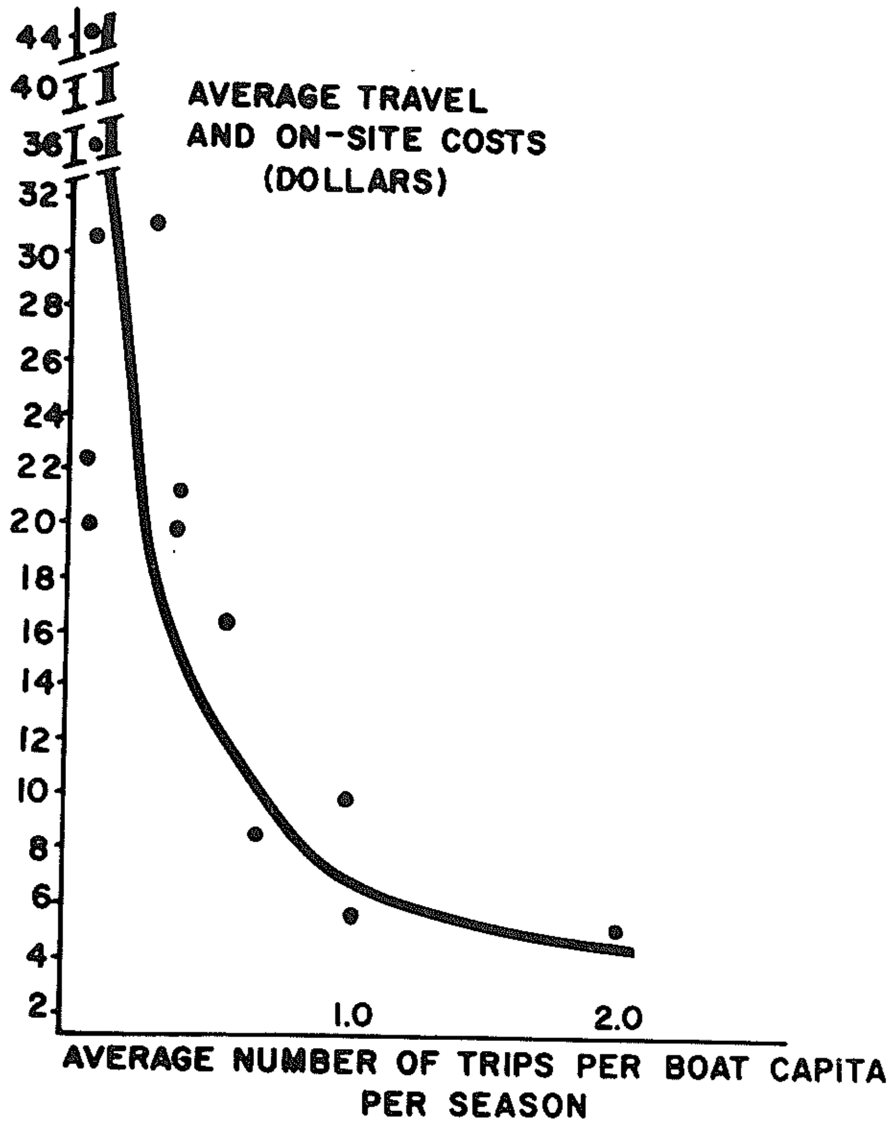
The Utah study reported an annual surplus value of $96,342 for Bear Lake when it was used for boating purposes, a surplus of only $3,433 for Hyrum Reservoir, and $6,635 for Mantua Reservoir. The demand curve computed for Bear Lake and used in the estimation of surplus value is shown in Figure 4.

RESULTS OF ECONOMIC STUDIES IN NEW MEXICO

An early study by Wollman et al. of the recreational value of water in the Rio Grande Basin used the value-added method (11). Wollman's results indicated a value of water for recreational purposes of $212 per acre-foot of Rio Grande water and $185 of diverted San Juan water.

The Ruidoso Study resulted in several sets of demand curves, for those living within 200 miles of Ruidoso and those living beyond 200 miles (8). Additionally, demand curves were constructed for each group based not only on their actual recreational experience expenses, but also on the maximum amounts they would be willing to spend for

FIGURE 4:
DEMAND CURVE
OF BOATERS
AT BEAR LAKE,
UTAH



the experience. These curves are shown in figures 5 and 6. Note the wide spread between the actual and maximum demand curves of local recreationists, and the closeness of the demand curves of actual expenditures of non-local recreationists and the maximum of local recreationists. All of these relationships appear reasonable.

When the total area under the demand curves is computed (expenditures per man day times number of man days), recreationists spent $10.8 million in the Ruidoso District, about $61 per acre in the District, or about $637 per acre-foot of surface and ground water produced in the District when uses are reallocated to their "best" use, with "best" meaning the maximum gross values, recreational values would have increased to $11.9 million per year and only an estimated 44 acre-feet of water would have been used for all camping, picnicking, cabin ownership, hunting, fishing and skiing activities.

If an optimum combination of uses had been made of the resources of the District, including the water resource, net cash receipts would have increased from $4.2 million to $11.5 million, or from $247 per acre-foot of water for all uses of water, to $679 per acre-foot. Let me caution you in using these values. They represent the net cash income of all uses (of which recreation is a large part). The values assume that all benefits accrue solely to the water resource and that recreational uses require a proportionate share of water. The fact that an estimated 16,943 acre-feet of water was used in the area and recreation required only about 44 acre-feet obviously indicates, despite the value of other uses, that the value of $247 and $679 per acre-foot probably is a gross underestimation of the value of water for recreational purposes in the Ruidoso District.

Some of the difficulties encountered in the Ruidoso Study using demand curve analysis and static linear programming were partially overcome in the Reserve Area using the input-output model (10). We did determine how 12 groups of businesses would be affected by a water-based recreational development. And we did determine precisely how much more water each of these groups of businesses would require with different projections of recreational uses into the future.

The intermediate level of recreational use in the Reserve Area anticipates that from the 1963 level of 825 recreationists there will be as many as 75,000 recreationists by 1967, and 151,300 recreationists by the year 2000. Using these projections, the total value of production for the various groups of businesses are shown in Table 1. By the year 2000 and based on the projected increase in the area, farms and ranches will be relatively unaffected, as will also lumber manufacturing, the two major industry groups in the area. The big gainers percentagewise will be the industry groups of real estate rentals; equipment, service and repair; grocery sales; the Forest Service; and restaurants and bars; in that order. All of the other industries will

FIGURE 5:
DEMAND CURVES OF RECREATIONISTS IN THE RUIDOSO AREA

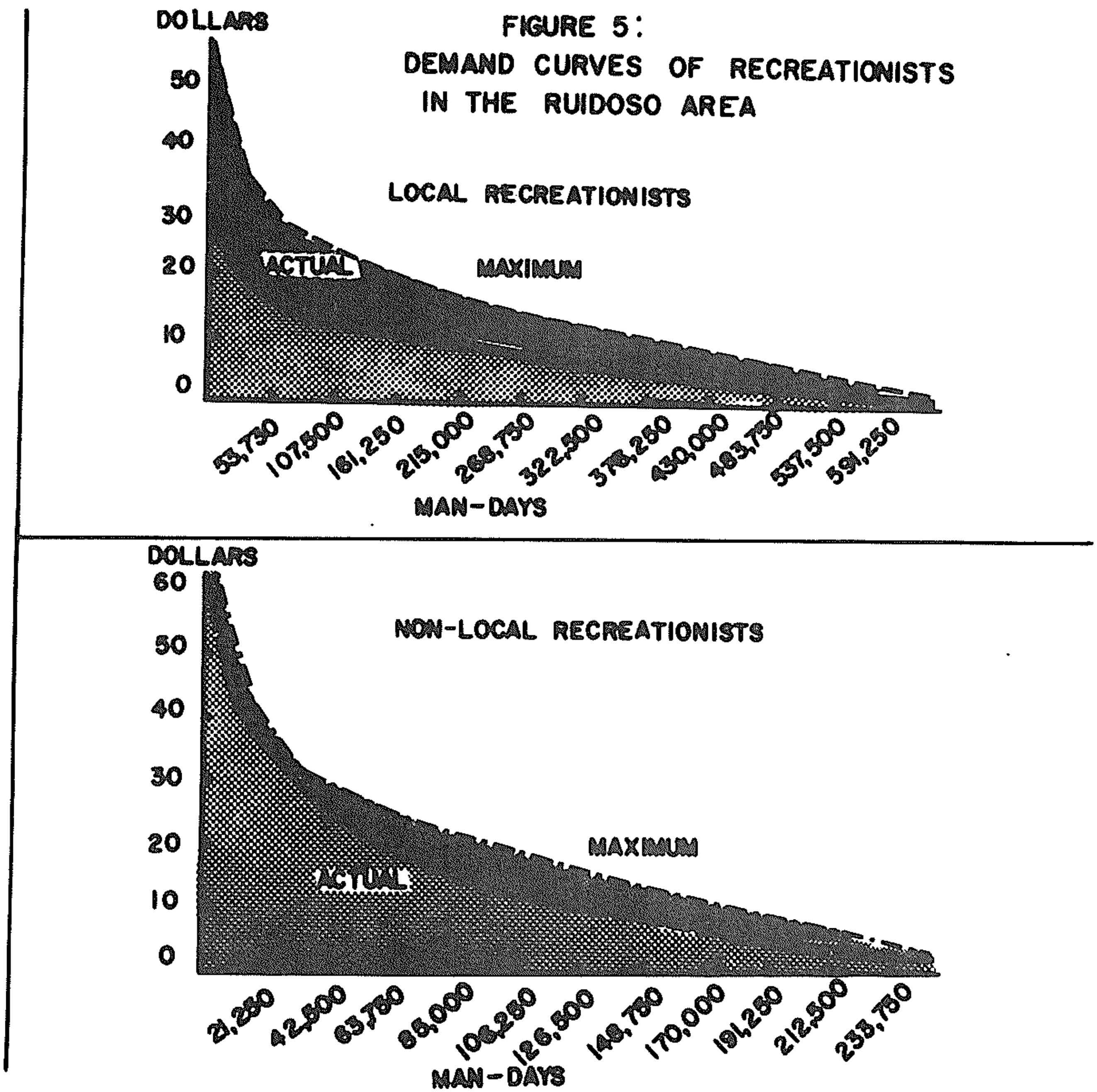


FIGURE 6:
CURVE COMPARISON

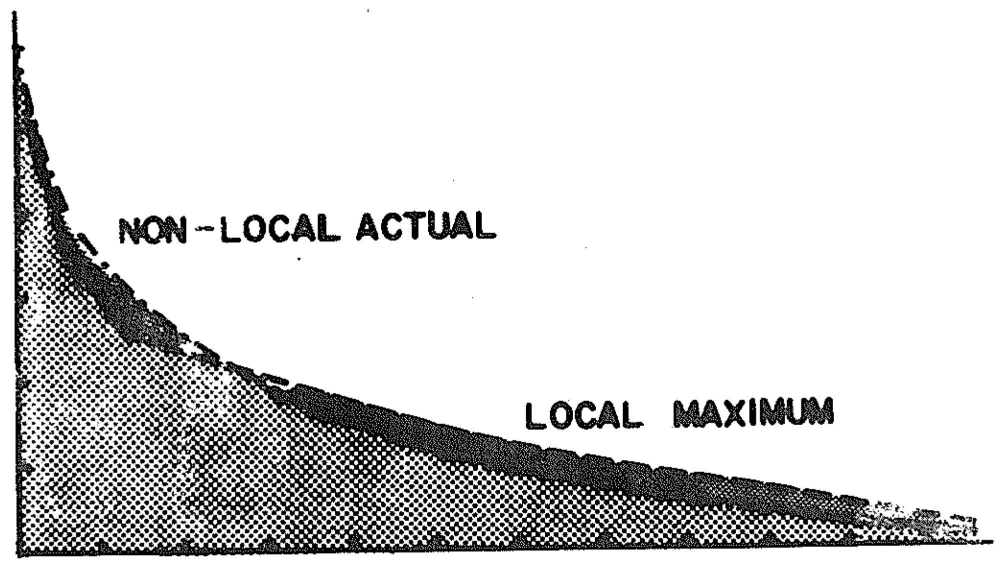


TABLE 1. Total Value of Production with an Intermediate Level Projection of Recreation in the Reserve Area

Major Industry Group	Total Value of Production In: 1963	2000
	Dol.	Dol.
Agriculture	409,301	431,217
Lumber Manufacturing	1,613,150	1,613,885
Utilities	74,820	82,914
Real Estate Rentals	22,731	73,161
Equipment, Service, Repair	110,199	289,766
Restaurants and Bars	108,150	168,898
Personal Service, Drugs	72,221	72,290
Grocery Stores	225,487	460,233
General Merchandise	83,900	88,958
Construction and Maintenance	291,006	299,365
Forest Service	88,485	164,995
Unallocated Services	130,224	134,054
Total	3,229,675	3,879,736

realize a ten percent increase or less in total production. Water requirements for all industries in the area will increase by only 13 percent (by a total of 55 acre-feet) even at the highest projected level of recreational activity. We concluded that in rural areas such as the Reserve Area the gain in local business activity will be modest, only about a half of the industry groups will be affected materially, and those benefiting the most will be industries supplying goods and services that recreationists cannot easily bring in with them.

FUTURE RESEARCH AREAS

One of the major handicaps in economic research dealing with recreational developments has been the popular philosophy that recreation somehow creates a value to consumers that is not readily measurable by economists, or that recreation has extra-market values (12). This philosophy has been attacked by Knetsch in an address to the Great Plains Council (12). According to Knetsch "economic values are measured basically by what people are willing to give. The relevant economic measure of recreation value, therefore, is a willingness to pay on the part of consumers for outdoor recreation services. This set of values is the same as the economic values which are established for other commodities, for it is the willingness to give up income on the part of consumers which establishes values throughout the economy."

This demolishing of the extra-market or esthetic value philosophy of recreation permits economists to push ahead using variations of the demand curve models already developed.

In Texas, a project is being undertaken dealing with an economic analysis of the demand for land and/or water-based outdoor recreation. The objectives are to construct demand functions (curves) and to analyze consumer preferences for outdoor recreation. The project began January 20, 1965. No completion date was included with the project outline.

In New Mexico, a project was initiated on September 1, 1965 to investigate the recreational values of water in the major reservoirs of New Mexico. The objectives of this project are to determine recreational demand schedules and demand price elasticities at Elephant Butte and Navajo reservoirs and to measure the changes in demand schedules for the major recreational activities as reservoir levels change from one season to subsequent seasons. The completion date is two years hence.

Other research currently being conducted include one by Raup in Minnesota which stresses the legal as well as the economic aspects of use, allocation, regulation and pricing of water among competing uses. A division of costs and benefits among competing uses is being attempted. Another study by Helfinstine has one objective of appraising the economic benefits to South Dakota of the non-agricultural uses of water from the Oahe Reservoir. A study of the Colorado River Basin by Therkildsen at the University of New Mexico includes an analysis of recreation in the upper Colorado River Basin.

The direction of future research would seem to indicate that rather than being concerned with methods of analysis and estimation of recreational values for groups of different mixes of natural resources, economists are now concentrating their efforts in attempts to analyze the recreational value of individual kinds of natural resources. Leading the way is research aimed specifically at determining recreational values of water.

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