The Demand for & Value of Hunting, Fishing and General Rural Outdoor Recreation in Arizona

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The Demand for & Value of Hunting, Fishing and General Rural Outdoor Recreation in Arizona

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FOREWORD

BACKGROUND AND PURPOSE

In early 1971, the Arizona Game and Fish Department authorized a survey of hunting and fishing within the state covering the year 1970, having the general objective of determining the total economic value of benefits assignable to fish and wildlife in Arizona. Three previous surveys [Armstrong, 1958; Davis, 1962; and 1967] concentrated on estimating expenditures and participation by hunters and fishermen, generally following what is termed the "gross expenditure" approach to estimation of the economic value of the activities.

The gross expenditure method attempts to measure the value of recreation to the community in terms of the total amount spent on recreation by the participant.1/ This method has been used in the past by many agencies throughout the country, particularly by state resource departments, and by travel departments and tourist promotion agencies. The contention of these departments and agencies has been that the value of a day's recreation must be worth at least the amount of money spent by a person for that purpose. Such expenditures have included travel expenses; expenses for equipment such as boats, motors, and tackle; and expenses incurred while in the recreation area. Estimates of gross recreation expenditures still are very popular in many quarters. Such estimates are easy to understand and are likely to yield large figures, which give the impression of a large and profitable tourist-recreation business.

Indeed, these values are of some use in indicating the amount of money spent on a particular type of outdoor recreation, although it must be recognized that they represent expenditures for many goods and services, some in the year under study but some in previous years. The figures also have some utility in establishing the income effects of recreation on residents in the area, and therefore in determining the effects of local investments for this purpose. But they are of little or no consequence for justifying public expenditure on recreation, or for determining the worth or benefit of recreation opportunities afforded.

What is needed is not some gross value but the value added by a particular recreation opportunity. It is the net increase in the value of the resource produced by using the resource for recreation that is crucial; this represents a true net yield that can be compared with what the resource would yield if it were in an alternative use producing other services. It is the margin above the cost of taking advantage of the recreation opportunity which measures the real monetary value that would be lost if the recreation opportunity were not available. The gross expenditure figures in themselves do not measure this. They tell us the magnitude of the industry, in one sense, but they do not indicate the value of the losses that would be sustained if the particular recreation opportunity were to disappear, or the value of the net gain from an increase in a particular recreation opportunity.

In this fourth report, the gross expenditure approach is abandoned. Instead, estimates of consumer benefits for hunting, fishing and general rural outdoor recreation that are consistent with current concepts in the estimation of economic demand for recreation activities are developed. The user benefit method that is employed starts with the estimation of an economic demand curve expressing demand for the whole recreation experience. Because expenditure data are used in the procedure, the method bears a superficial resemblance to the gross expenditure method. Each approach depends on information on expenditures by recreationists--money spent for travel, meals, lodging, equipment, etc. Since it was necessary to gather the expenditure data, those data are reported in a companion report entitled *Participation and Expenditures for Hunting, Fishing and General Rural Outdoor Recreation in Arizona*, Arizona Agricultural Experiment Station Research Report No. 270 [Gum, et al., 1973].

In the previous three studies, information was developed pertaining to the participation and expenditure of only licensed sportsmen in hunting and fishing activities. Yet, it has been recognized that persons other than licensed sportsmen participate and spend monies for hunting and fishing. For example, the wife and young family of a licensed fisherman may accompany him on a fishing trip, and while they may not fish, they are making additional expenditures. In some sense, they are equal participants on the trip. Without their presence, it is possible that the fishing trip may not have been made by the licensed sportsman at all. Such a combination purpose trip is often true for fishing, true to a lesser extent for hunting trips, and is generally true for other types of rural outdoor recreation. If only the expenditure of licensed sportsmen is recorded, there will be underestimation of the actual expenditures that hunting and fishing trips induce.

After reviewing the 1970 outdoor recreation data, the authors were convinced that the family is the decision making unit and that the household is the more valid and meaningful recreation unit to analyze than is the licensed sportsman. The decisior to recreate in a particular activity in the lakes, streams, woods and deserts of Arizona is made by individuals within a household setting. The various interests, available time and resources of each

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1/ This explanation of gross expenditures versus economic value heavily paraphrases two basic references on the economics of recreation--Clawson [1959] and Clawson and Knetsch [1966].

household member within the household setting leads to an individual or joint decision, either explicitly or implicitly. For example, the decision of a licensed small game hunter to go dove hunting one Saturday morning, by himself, is still made within the context of the alternatives, time and income available to him and his family. Another small game hunter may only make the same trip if he can take one or more of the non-licensed family members along. Thus, the emphasis in this report is on the demand for and value of a recreation area and activity to a household.

The decision to study the recreational activities of households rather than licensed sportsmen allowed the possibility of expanding the number of rural outdoor recreational activities which could be researched. Therefore, rather than sampling from a population list made from duplicate fish and game licenses, a more general population list was chosen. The 1970 Arizona automobile registration list reduced to a household basis was used under the assumption that a family needed a passenger vehicle in order to recreate in the rural outdoors. The technical aspects of how the sample of residents was drawn are described fully in Appendix A.

The procedure for estimating economic demand functions is not easily adaptable to include demand by nonresidents of the state. Therefore, to the extent that nonresidents participated in hunting, fishing and general rural outdoor recreation in Arizona in 1970, the value of the resources devoted to these activities are underestimated. Expenditures and participation in hunting and fishing activities in Arizona by nonresidents is reported by Gum, et al., [1973].

The general method employed in this current study of the demand for and the value of the resources areas when used in various recreational activities is the Clawson-Hotelling approach [1959, 1949]. This method has been modified and improved over time by many researchers. An example of one of the pioneering efforts in the field is the study of the Oregon Salmon and Steelhead sport fishery by Brown, Singh and Castle [1964]. Brown and Nawas [1972] recently showed how estimates of value could be significantly improved over the traditional approach by using observations on individual recreators rather than averaging individual observations within residence zones. This reported research on rural outdoor recreation throughout Arizona gave the opportunity to use a large number of individual observations, as did Brown and Nawas. In addition, by focusing on all types of rural outdoor recreation activities in all regions of the state, it was possible to include the prices of substitute recreation attractions as variables in the estimated demand equations. To the authors' knowledge, this is the first time that substitute attractions have been included as an integral part of the demand estimation process.2/

The data were gathered from questionnaires mailed to nearly 15,000 resident households and almost 1,000 nonresident households in the spring of 1971. Usable replies were secured from 2,985 residents and 235 nonresidents. Information was obtained on each of five hunting activities, two fishing activities, and on general rural outdoor recreation in each of the seven 1970 Arizona Game and Fish Department Regions in the state. The activities are cold water fishing (trout), warm water fishing (bass, catfish, etc.), deer hunting, other big game hunting (antelope, bear, bighorn sheep, elk, javalina, turkey), small game hunting (squirrel, rabbit, quail, dove), general hunting (predatory animals, i.e., foxes, coyotes, etc.), waterfowl hunting (ducks and geese), and general rural outdoor recreation.

General rural outdoor recreation includes day picnicking, overnight camping, hiking, swimming, boating, water skiing, birdwatching and snow skiing. These eight general recreation activities make use of the same land and water resources of the state as do hunting and fishing. They are either complementary, supplementary or competing uses to the resources involved with hunting and fishing activities.

Thus, this bulletin reports estimates of demand for and the value of eight hunting, fishing, and general rural outdoor recreation activities in each of the seven 1970 Regions in Arizona. The report first outlines the conceptual framework for estimating the value of recreation, then presents the estimates of value for Arizona, and finally puts these values in context by making some comparisons with the values of the same natural resource areas when used in nonrecreational activities. Technical details of the estimation process, including problems of response bias, are reserved for Appendix A.

SUMMARY OF VALUES

The total net benefit3/ (consumer surplus value) for the state for all hunting in all regions in 1970 was $34,480,315. Small game hunting was almost half of this total with $15,651,167. Deer and other big game hunting generated most of the balance of value, with general hunting generating $901,749 and waterfowl hunting generating almost $600,000.

2/ Boyet and Tolley [1966] briefly mention estimates of cross elasticities between visits to major national parks, using aggregative secondary data with distances serving as the surrogates for the costs of visiting alternative sites.

3/ The term "total net benefit" is used to describe the consumers' surplus value in order to distinguish these values from "gross expenditures". The benefits are net to the consumer, above their costs of participation. The benefits are not, however, net of production and maintenance costs--costs which are borne by the producer and not passed on to the consumer as a cost of participation.

The total net benefit for fishing was $64,374,326, almost twice that for hunting. Warm water fishing generated $34 million while cold water fishing generated $30 million. The greatest value for cold water fishing is in the White Mountain area of Region 1. The greatest warm water value was generated in the larger Central Arizona lakes of Region 5.

All general rural outdoor recreation activities generated over $144 million in consumer surplus, about 60 percent of the state grand total for all hunting, fishing and other rural outdoor recreation.

Values were also estimated using the nondiscriminating monopolist approach. The consumer surplus approach shows the total net benefit to the consumers generated by a particular activity, assuming a zero entry fee and the number of trips taken in 1970. The nondiscriminating monopolist values show the maximum total revenue that could have been collected if the optimum entry fee were charged for every participant household-trip. Associated with the price of the optimum entry fee and the nondiscriminating monopolistic value is the number of household-trips that would have been taken at that price. The state total for the value of hunting, using the nondiscriminating monopolist procedure, was $13,885,814. The value for fishing was $30,057,922 while the value for general rural outdoor recreation was $91,582,973.

When total values were converted to values per square mile of huntable range and values per surface acre of water, it was found that the values to the natural resources when used for recreation purposes were quite comparable to values of the same resource when used for purposes such as cattle ranching or irrigation water.

ESTIMATING THE VALUE OF OUTDOOR RECREATION

That outdoor recreation has "value" is a fact that most people will admit. It is the size of this "value" that remains in question. The problem is that outdoor recreation is not bought and sold in the open market as are most other goods that have "value".

Some people argue that outdoor recreation is of such a high value it is priceless. Until recently, many planners and administrators have shared this view and have been unwilling to include measures of the monetary value of outdoor recreation in the management decisions that affect resource use. They felt that recreation value defies any type of measurement although persons appreciative of outdoor recreation felt the value was "large". Still others argue that any positive monetary value such as the current recommendations of the Water Resources Council's [1973] rather arbitrary value of $3.00 to $9.00 per user day for specialized purposes such as big game hunting is as reasonable as any other value.

Concomitant with the confusion and disagreements over both the magnitude and measurability of the value of outdoor recreation there exists a need by those involved in making decisions concerning outdoor recreation development and management for realistic and acceptable measures of outdoor recreation value. For instance, in a decision as to the desirability of building campground facilities, a monetary measure of the value of the development is often necessary to justify its construction. Certainly any funds used to support outdoor recreation activities could have been spent for other purposes. If the "other purpose" has a value, one needs to know the value of the recreational activity in order to make a rational choice in allocating the funds.

If one accepts Thorndike's dictum "Whatever exists at all, exists in some amount" [Thorndike, 1918], one must believe that the value of outdoor recreation is some definable quantity. The task then becomes one of first setting a theoretical framework for the economic value of outdoor recreation and second, developing and implementing a method to measure that value.

ECONOMIC DEMAND

Conventional Demand Curves

Economic values are measured by what people are willing to give up in order to enjoy possession of a good or service. This explanation of value is conceptually the same for an outdoor recreation experience as it is for any other good or service except that most outdoor recreation goods lack a formal market-determined price. Consumers of any economic goods must receive satisfaction (utility) that is at least equal to the price that they are willing to incur, otherwise they would not be acting rationally in incurring the expense. With a market-price commodity, the price that is paid in the market (along with the cost of time and effort a person spends getting to the market) regulates the amount that a person purchases of a product. Likewise, the money and distance (time) costs of a recreational activity will determine the amount of participation of individual recreators, and the satisfaction (utility) received must be at least equal to the cost the people are willing to incur.

In order to construct demand estimates for outdoor recreation that approximate those for market-priced goods, it is essential that an appropriate money-cost price be determined. If these costs can be defined, then it is possible to derive statistical demand estimates that are equivalent to market-priced commodities. Conventional demand schedules, whether they be theoretical or empirical, relate alternative quantities that would be purchased to alternative market prices at a given point in time.

The basic principle of demand is that the quantity demanded varies inversely with the per unit price. At a high price, a relatively small quantity will be demanded. At a lower price, more of the commodity will be taken. A typical linear demand curve would look as shown in Figure 1.

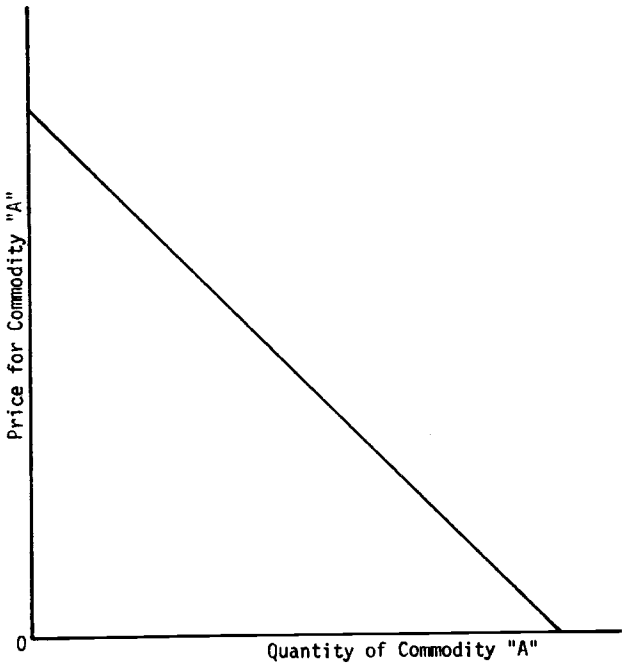

FIGURE 1. TYPICAL LINEAR DEMAND CURVE (HYPOTHETICAL

If all other things are held constant, a change in price for commodity "A" would cause a change in the quantity of commodity "A" as described by the demand curve in Figure 1. Changes in the factors other than the price of the commodity in question may cause a complete shift in the demand curve either to the right or left of the current demand curve. A shift to the right of the current position of the demand curve would indicate an increase in demand. Demand shifters include changes in income, population, the prices of other competing or complementary commodities, consumer tastes and preferences, and the time and effort involved in purchasing the product.

Economic Demand for Recreation

Recreation demand is simply a modification of conventional consumer demand. The basic notion of the relationship between price and quantity remains unchanged.

For recreation demand, the quantity variable is usually in terms of use. The use of recreation areas can be measured by such things as visits, trips, or user-days. The concept of the use of a recreation site is only part of what Clawson [1959, 1966] calls the whole recreation experience. The whole experience includes anticipation and preparation for the trip, travel to the site, the actual on-site experience, travel back from the site, and recollection of the experience. Clawson maintains that all five phases are present in every major outdoor recreation activity. It is difficult to separate one part from the others and as statisticians, we measure what people do in terms of the total recreation experience consumed and the costs involved.

The major difference between the demand for recreation and ordinary market-priced consumer demand is that of defining prices. In the conventional type of demand, the price of the commodity is established by a functioning market mechanism wherein the equilibrium price occurs at the point where supply is equated with demand. In contrast, most forms of outdoor recreation have no conventional market mechanism. Alternative quantities of recreation are not offered for sale at alternative prices. Consumer prices are either totally absent or set by administrative fiat.

Wennergren [1967], in exploring the early work of Clawson, examined the problem of pricing outdoor recreation and showed that although outdoor recreation developed as a non-market good, it is not a free good. There are time and money costs associated with the consumption of recreation which regulate the quantity of outdoor recreation taken. These money costs can be used as surrogate or substitute prices in determining demand functions for outdoor recreation with the time costs acting as demand shifters.

A problem arises in determining which costs are to be included as the surrogate price. There are two cost-related decisions that a potential recreator must face. First, there is the long-run decision to participate in some form of outdoor recreation. This long-run decision requires the purchase of certain items of a fixed nature such as camping equipment, a recreation vehicle, or other special sporting equipment. These expenditures on items which may be used for more than one trip and in more than one time period, are traditionally called fixed costs. Once these costs have been incurred, they are not affected by the decision to actually participate in a particular recreation activity. Because they are unaffected by a short-run participation decision, they, in turn, do not themselves affect the short-run decision.

The second decision that the individual must face is of a short-run nature. Here, within a given period of time, the individual must decide what form of recreation in which he will participate and at what site. In this case, the important considerations are time, travel costs, and any additional on-site costs that would not have been incurred had the individual remained at home. The travel costs and any additional expenditures are called variable costs (the costs affected by the short-run decision to recreate) and are the pertinent costs for the surrogate price.

The use of variable costs as the surrogate price is analogous to the short-run decisions made by a business firm. Economic analysis shows that in the short-run, the marginal costs (additional costs) are a function only of the variable costs and that the marginal costs are the decision variables. The short-run decision of how much to produce is not affected by the fixed costs. In the same way, only the variable costs are pertinent in estimating the short-run demand for recreation.

Estimating Demand for Outdoor Recreation

Estimation of demand for the use of a particular outdoor recreation activity at a particular site or in a particular area proceeds in two steps. One first must estimate a statistical demand curve for the total recreation experience. Then, the demand curve for the recreation resource itself (for example, the use of a particular area for hunting deer), is derived by relating posited added costs (e.g., alternative levels of entrance fees) to the number of visits made to the area for the particular purpose.

A simple example of the procedure, taken from Clawson and Knetsch [1966] is presented below. The data needed in order to derive the demand for the whole recreation experience for this hypothetical example are listed in Table 1. In this example, the costs from a particular area of residence to the recreation site (for example, a game region) are assumed to be the same for every visitor from the same area of residence. The number of visits is put on the basis of per 1,000 population from the area of residence. By plotting costs from column (3) against the corresponding number of visits per thousand population in column (5), a statistical demand

TABLE 1. PRICES AND QUANTITIES FOR STATISTICAL DEMAND (HYPOTHETICAL)

Area of Residence	Population of Area of Residence	Cost from Area of Residence to Recreation Site	Number of Visits to Site	Visits per 1,000 Population
1	1,000	$1.00	500	500
2	4,000	3.00	1,200	300
3	10,000	5.00	1,000	100
			2,700	

Source: Clawson and Knetsch (1966).

curve for the total recreation experience can be determined. This curve is shown in Figure 2.

The second step in the analysis is that of developing a demand curve for the resource site itself. This demand curve is derived from the demand curve for the recreation experience based on the assumption that the resource users would react to changes in costs at the site in the same manner to which they react to costs for the recreation experience as a whole. In developing the demand curve for the resource, the total projected number of visits is calculated at each posited increased interval of cost.

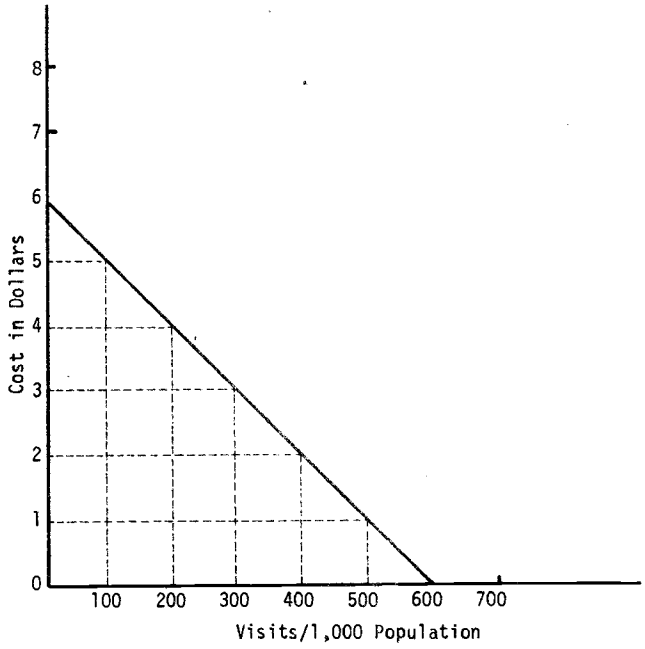

FIGURE 2. DEMAND CURVE FOR THE TOTAL RECREATION EXPERIENCE.

Source: Clawson and Knetsch (1966).

The resulting demand curve is in terms of added costs and total quantities of visitation.

For example, in this study the statistical demand curve for the total experience of hunting deer in Region 7 is used to develop a demand curve that describes the alternative quantities of deer hunting trips that would be made to Region 7 at alternative additional costs--for example, at alternative entry fee charges. Of course, access to the region for the activity is now free, and probably always will be, but we wish to know how much households would pay and participate if a fee were charged; that is, if participation in that activity in that region had a market price just as do most other economic goods or services.

The following example shows this second step. The total quantity of visits made at the existing costs are 2,700 as shown in Table 1. By adding increments of one dollar to each original cost, the corresponding projected quantity of visits can be determined in the following manner:

At the $1 added cost per visit from distance zone 1, the number of visits per 1,000 population is determined from Figure 2 to be 400. In essence, at a cost of $2 per visit, the number of visits per 1,000 from distance zone 1 is 400. This figure is then converted to total visits at the $1 added cost in the following manner:

$$\frac{400}{1,000} \times 1,000 = 400$$

That is, at the $1 added cost,

$$\frac{\text{visits}}{1,000 \text{ pop.}} \times \text{population of the distance zone}$$

$$= \text{total visits}$$

This same process is repeated for each distance zone. The total visits for each distance zone at the $1 added cost per visit are summed to establish one point on the demand curve for the resource itself.

This procedure is repeated for different added costs to arrive at a schedule as shown in Table 2. The points of added cost and total visits as shown in Figure 3, are points on the demand curve for the resource itself. This curve shows the alternative number of visits that would be taken at alternative entry prices, if an entry fee were charged. It is this demand curve for the resource that is important in valuing the resource. Estimates of value may be made by two methods as described below.

ECONOMIC VALUE

Consumers' Surplus Value

Simply defined, consumers' surplus measures the surplus satisfaction that a consumer receives from a

TABLE 2. VALUES FOR TOTAL QUANTITY OF VISITS AND ADDED COSTS (HYPOTHETICAL).

Area of Residence	Number of Visits at Added Cost Per Visit of					
	0	$1.00	$2.00	$3.00	$4.00	$5.00
1	500	400	300	200	100	0
2	1,200	800	400	0	0	0
3	1,000	0	0	0	0	0
Total Visits	2,700	1,200	700	200	100	0
Total Revenue Generated	0	$1,200	$1,400	$600	$400	0

Source: Clawson and Knetsch (1966).

commodity above the price that he actually paid for that commodity. The central idea behind consumers' surplus is that the consumer has in his mind a price that he would be willing to pay rather than to go without a certain commodity. The price that the person is willing to pay rather than go without must be greater than or equal to the price he actually does pay. Since price is a measure of satisfaction, the difference in price that the individual is willing to pay and the price that he does pay is a measure of surplus satisfaction. For example, looking at Figure 3, it is seen that at least one person would be willing to pay as much as $5 to make a visit. Other people would visit only if the price was less and finally 2,700 visits would be made if the price were zero. At a zero price, all persons who would have been willing to pay more than zero in order to make the visit would be receiving consumer surplus. The total consumers' surplus value would be equal to the total area under the demand curve, that is, the sum of the surplus satisfaction generated by each visit.

Since there is essentially no entry fee for most hunting, fishing and other outdoor recreation activities, the entire area under the demand curve for the site measures the quantity of consumer surplus value.

The consumer surplus value may be interpreted as the total net value of the resource site to the consumers when used for a particular purpose such as (for example) deer hunting. A disadvantage of the consumer surplus approach to valuation is that one usually will not have other consumer surplus values for the resource when used in alternative uses, with which to make comparisons. For example, we know the

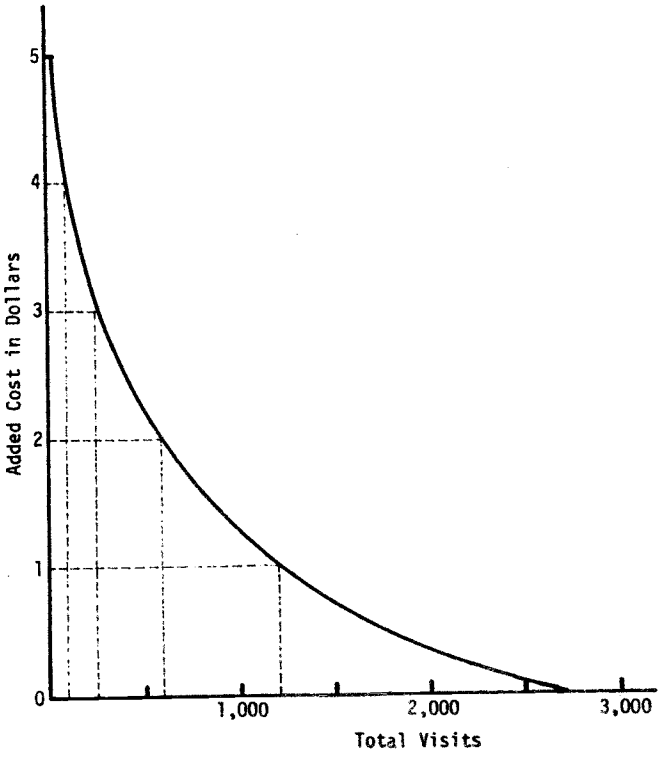

FIGURE 3. DEMAND CURVE FOR THE RESOURCE (HYPOTHETICAL).

Source: Clawson and Knetsch (1966).

price that individuals are willing to pay for a land area for use as a cattle ranch, but rarely, if ever, will have an estimate of the consumer surplus generated by such use to compare with the consumer surplus generated by use of the same land for hunting. Thus, the consumer surplus value is most useful as a monetary measure of the maximum net value that (for example) hunting generates in an area. For purposes of comparison with other uses of the resource, it is more useful to be able to assign a single price that is associated with the value estimate. For this reason, a second method of valuation is also used.

Nondiscriminating Monopolist Value

The nondiscriminating monopolist method for determining resource values for outdoor recreation allows introduction of a single price. This model assumes the existence of a single monopolistic owner of the resource. The rational monopolistic owner would want to charge the price for the resource that would maximize the total revenue from the resource. He must select one single optimum price for the good since, as a practical matter, he cannot discriminate between consumers relative to the price he charges and charge each the maximum price that that

particular consumer would pay. (If he could do so, he could collect all of the consumer surplus.) Figure 4 shows the relationship between demand (D) and maximum total revenue (TR) generated by the optimum price (P_o). Maximum total revenue is the area of the largest rectangle that can be drawn under the demand curve and defines a particular price (P_o) and associated quantity (Q_o). Maximum total revenue is that portion of consumers' surplus that could be extracted by an all powerful monopolist (e.g., The Arizona Game and Fish Department) charging a single price. Using this method, the value of the resource is the maximum net revenue that could accrue to an agency by charging a given fee. Note that we are not suggesting that such a fee be charged. The method is simply a way of obtaining a price and value that can be compared to values of the basic resource in alternative uses.

In the following section, we present estimates of consumer surplus values and nondiscriminating monopolist values for eight rural outdoor recreation activities in the seven Arizona Game and Fish Department Regions in Arizona.4/ These values are compared to the estimates of gross expenditures actually generated by these activities in 1970 in Appendix B.

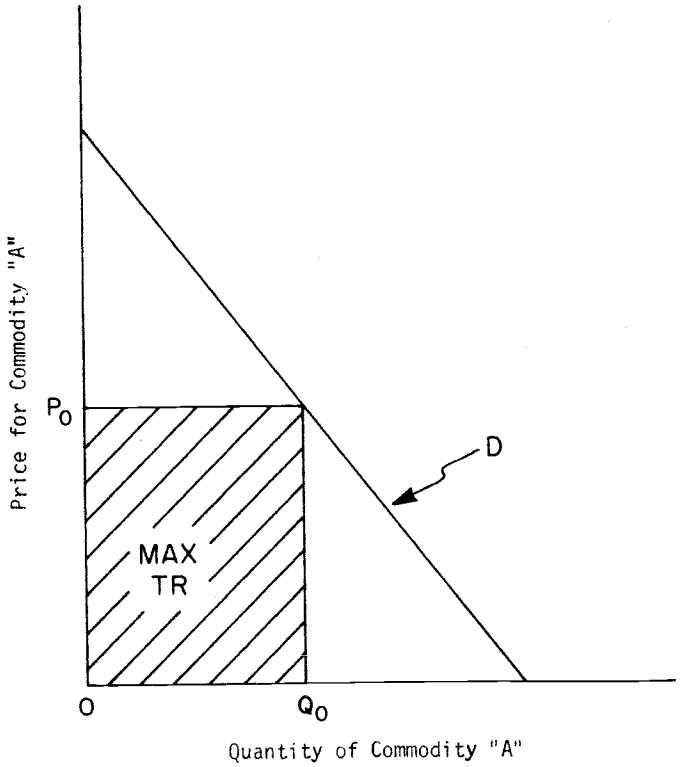

FIGURE 4. RELATIONSHIP BETWEEN DEMAND AND MAXIMUM TOTAL REVENUE GENERATED BY THE OPTIMUM PRICE.

4/ The seven regions existent in 1970 have since been consolidated into six regions. Since the data were gathered on the basis of 1970 conditions, however, the 1970 regions are used herein.

VALUES FOR HUNTING, FISHING AND GENERAL RURAL OUTDOOR RECREATION IN ARIZONA FOR 1970

RESOURCE AREAS

The seven 1970 Arizona Game and Fish Department Regions are shown in Figure 5. Data were originally gathered relative to the smaller Game Management Units shown in Figure 6. Demand curves and resource values were estimated only for the Regions, however, since even with observations on 2,985 recreators, data were too sparse to make estimates on the smaller Units. Even using the larger Regions, with 7 Regions and 8 activities, 56 statistical demand estimates were required. Region boundaries are not always precisely congruent with the sum of several smaller Units, therefore, some judgment was necessary in aggregating Unit data into data on Regions.

Figure 7 shows the 14 Arizona counties, also for comparison with the 7 Game and Fish Department Regions. These 14 counties were used as the areas of residence for purposes of population sampling as explained in detail in Appendix A. Details of the empirical estimation process are also in Appendix A.

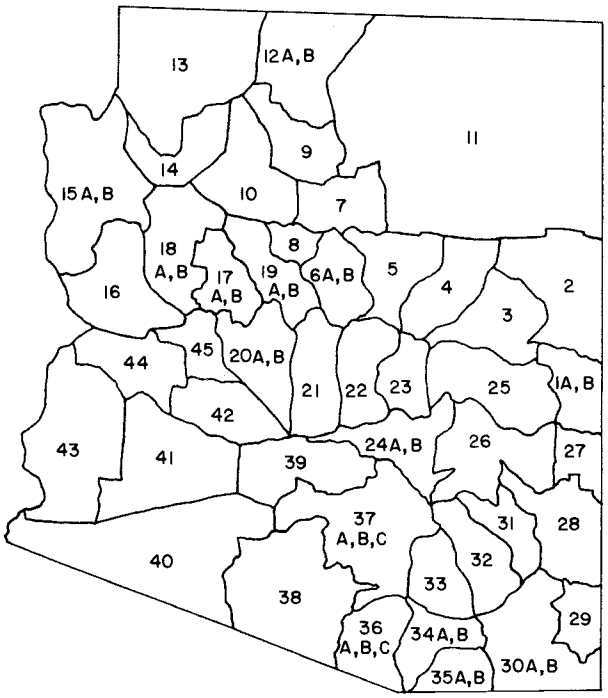

FIGURE 6. ARIZONA GAME AND FISH DEPARTMENT GAME MANAGEMENT UNITS, 1970.

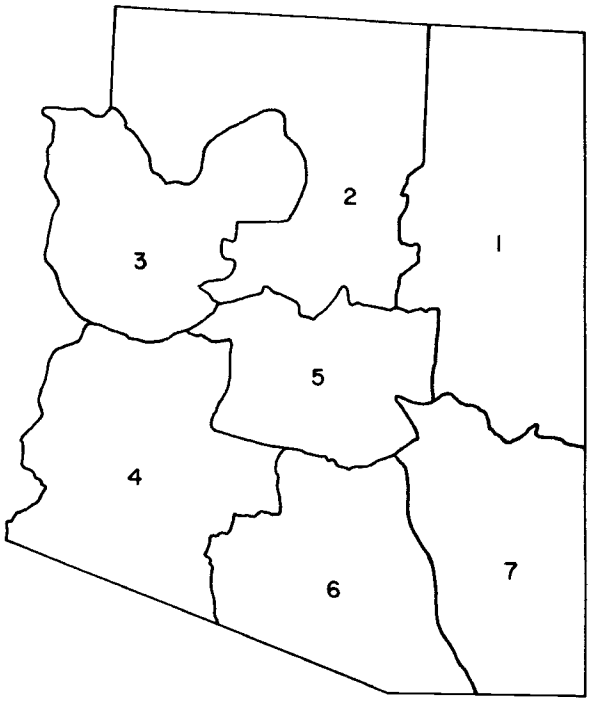

FIGURE 5. ARIZONA GAME AND FISH DEPARTMENT REGIONS, 1970.

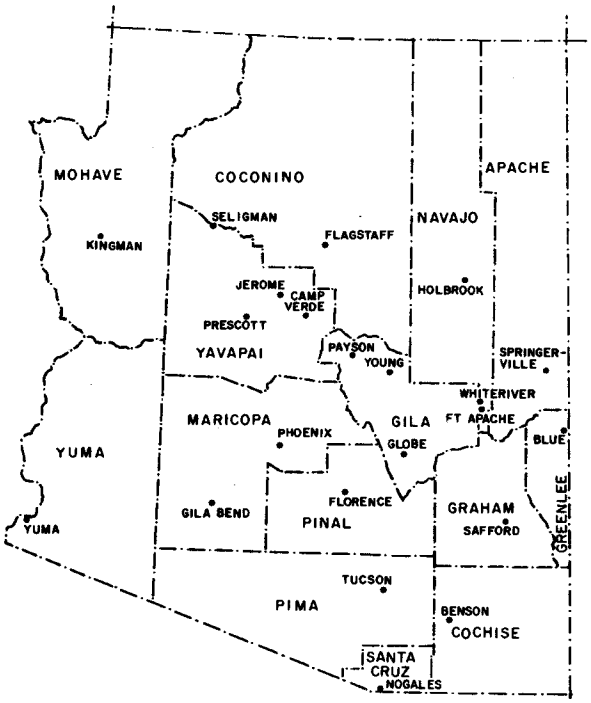

FIGURE 7. MAP OF THE COUNTIES OF ARIZONA.

CONSUMER SURPLUS VALUES

Estimated values of consumer surplus generated by hunters, fishermen and general rural outdoor recreators are presented in Table 3 for each of the eight activities in each of the seven Game and Fish Regions. The numbers of household trips made in 1970 that are associated with the consumer surplus value are also shown.

The value for the state for all hunting in all regions was $34,480,315. Small game hunting was almost half of this total with $15,651,167. Deer and other big game hunting generated most of the balance of value, with general hunting generating $901,749 and waterfowl hunting generating almost $600,000.

The total net benefits for fishing was $64,374,326, almost twice that for hunting. Warm water fishing generated $34 million while cold water fishing generated $30 million. The greatest value for cold water fishing is in the White Mountain area of Region 1. The greatest warm water value was generated in the larger Central Arizona lakes of Region 5.

All general rural outdoor recreation activities generated over $144 million in consumer surplus, about 60 percent of the state grand total for all hunting, fishing and other rural outdoor recreation.

Also shown are the average consumer surplus values generated per household-trip in each of the eight recreation activities. These values range from a high of $66.54 per general rural outdoor recreation household-trip (including camping and boating) down to $6.39 per household-trip for general hunting.

TABLE 3. CONSUMER SURPLUS VALUES GENERATED IN 1970, BY ACTIVITY AND ARIZONA GAME AND FISH REGION.

Activity and Region	Trips Made in 1970	Consumer Surplus Value ($)	Average Consumer Surplus Per Trip ($)
Deer Hunting			
Region 1	24,250	739,460	
Region 2	65,871	5,200,161	
Region 3	12,718	359,546	
Region 4	7,582	453,452	
Region 5	31,959	514,352	
Region 6	38,304	2,062,223	
Region 7	32,128	1,917,056	
State Total	212,812	11,246,250	52.85
Other Big Game Hunting			
Region 1	21,087	1,883,041	
Region 2	24,377	1,038,362	
Region 3	777	44,623[a]	
Region 4	545	31,299[a]	
Region 5	25,919	2,108,559	
Region 6	22,944	717,030	
Region 7	10,571	277,353	
State Total	106,220	6,100,267	57.43
Small Game Hunting			
Region 1	14,097	103,699	
Region 2	29,163	512,806	
Region 3	14,156	175,483	
Region 4	70,283	1,494,521	
Region 5	264,832	6,981,756	
Region 6	176,962	4,314,587	
Region 7	85,516	2,068,315	
State Total	655,009	15,651,167	23.89
Waterfowl Hunting			
Region 1	4,192	51,858	
Region 2	4,648	28,217	
Region 3	4,061	40,082[a]	
Region 4	17,633	151,941	
Region 5	7,725	76,246[a]	
Region 6	12,015	118,588[a]	
Region 7	8,566	113,950	
State Total	58,840	580,882	9.87

TABLE 3. (CONTINUED)

[a] Consumer surplus for this activity in this region computed indirectly as the average value per trip for all other regions for this activity. Consumer surplus for all activities and regions not footnoted was computed directly from the relevant second-stage demand function. Indirect computation was necessary in those cases where a reliable statistical demand curve could not be estimated.

NONDISCRIMINATING MONOPOLIST VALUES

Estimates of the nondiscriminating monopolist values for each region and activity, along with the prices that would create the value are summarized in Table 4. These values range from about one-fourth to about one-half of the corresponding consumer surplus values. Recall that the consumer surplus values showed the total net benefit to the consumers generated by the Region when used for a particular activity, assuming a zero entry fee and the number of trips taken in 1970. These nondiscriminating monopolist values show the maximum total revenue that could have been collected if the optimum entry fee were charged for every household-trip into the Region for this particular purpose. Associated with the price of the optimum entry fee and the nondiscriminating monopolistic value is the number of household trips that would have been taken at that price. The associated number of trips are shown in the detailed tables that follow.

These monopolist values represent the amount of surplus satisfaction that could be extracted by an all powerful monopolist charging a single price to all consumers. However, even a monopolist could not extract an amount equal to the total value of consumers' surplus. To do so, one would have to charge each consumer the maximum price that he would be willing to pay. Therefore, nondiscriminating monopolist values are lower than consumers' surplus value.

The state total for the nondiscriminating monopolist value for fishing was more than twice the total for hunting, whereas, the consumer surplus value for fishing was somewhat less than twice the hunting value. The general rural outdoor recreation monopolist value is about 50 percent of the state grand total for all rural outdoor recreation activity including hunting and fishing.

TABLE 4. NONDISCRIMINATING MONOPOLIST VALUES, BY ACTIVITY AND ARIZONA GAME AND FISH REGION, 1970.

Activity and Region	Nondiscriminating Monopolist Price ($)	Nondiscriminating Monopolist Value ($)
Deer Hunting,		
Region 1	35	343,934
Region 2	60	1,433,769
Region 3	45	159,394
Region 4	60	171,813
Region 5	15	157,037
Region 6	100	1,014,809
Region 7	120	805,902
State	60	3,717,064[a]
Other Big Game Hunting,		
Region 1	70	479,857
Region 2	50	465,367
Region 3		b
Region 4		b
Region 5	130	1,202,048
Region 6	40	368,744
Region 7	60	108,543
State	40	2,034,966[a]
Small Game Hunting,		
Region 1	15	45,185
Region 2	45	215,256
Region 3	20	89,846
Region 4	45	756,155
Region 5	50	3,868,521
Region 6	35	2,559,916
Region 7	45	1,055,389
State	35	7,752,495[a]
Waterfowl Hunting,		
Region 1	25	24,005
Region 2	10	11,114
Region 3		b
Region 4	20	56,499
Region 5		b
Region 6		b
Region 7	20	47,224
State	20	127,412[a]

[a] The nondiscriminating monopolist value for the state for a particular activity is less than the sum of the nondiscriminating monopolist values for each region for that activity (see text, page 14).

[b] Value could not be estimated because of too few observations to develop the statistical demand function. The value can be assumed to be relatively small compared to the other regions which are more heavily used for the particular activity.

TABLE 3. (CONTINUED) CONSUMER SURPLUS VALUES.

Activity and Region	Trips Made in 1970	Consumer Surplus Value ($)	Average Consumer Surplus Per Trip ($)
General Hunting			
Region 1	7,261	95,537	
Region 2	20,962	49,089	
Region 3	4,982	20,826	
Region 4	13,196	84,322[a]	
Region 5	50,951	353,634	
Region 6	31,794	183,014	
Region 7	11,912	115,327	
State Total	141,058	901,749	6.39
STATE TOTAL, ALL HUNTING	1,173,939	34,480,315	
Cold Water Fishing			
Region 1	279,050	21,058,930	
Region 2	179,869	5,016,989	
Region 3	38,792	1,625,167	
Region 4	1,633	81,862[a]	
Region 5	44,003	865,388	
Region 6	31,579	728,385	
Region 7	28,417	867,756	
State Total	603,343	30,244,477	50.13
Warm Water Fishing			
Region 1	20,503	1,279,614	
Region 2	32,959	664,687	
Region 3	55,347	6,623,530	
Region 4	83,284	1,719,646	
Region 5	405,535	21,405,617	
Region 6	20,503	274,678	
Region 7	125,138	2,162,077	
State Total	743,269	34,129,849	45.92
STATE TOTAL, ALL FISHING	1,346,612	64,374,326	

TABLE 3. (CONTINUED) CONSUMER SURPLUS VALUES.

Activity and Region	Trips Made in 1970	Consumer Surplus Value ($)	Average Consumer Surplus Per Trip ($)
General Rural Outdoor Recreation			
Region 1	224,943	30,765,878	
Region 2	464,093	55,856,978	
Region 3	95,174	4,885,540	
Region 4	103,890	3,807,327	
Region 5	737,094	28,493,414	
Region 6	599,533	14,907,480	
Region 7	160,106	5,665,300	
State Total	2,384,833	144,381,917	66.54
STATE GRAND TOTAL, ALL ACTIVITIES	4,905,384	243,236,558	

[a] Consumer surplus for this activity in this region computed indirectly as the average value per trip for all other regions for this activity. Consumer surplus for all activities and regions not footnoted was computed directly from the relevant second-stage demand function. Indirect computation was necessary in those cases where a reliable statistical demand curve could not be estimated.

TABLE 4. (CONT'D) NONDISCRIMINATING MONOPOLIST VALUES.

Activity and Region	Nondiscriminating Monopolist Price ($)	Nondiscriminating Monopolist Value ($)
General Hunting,		
Region 1	20	47,466
Region 2	10	19,454
Region 3	5	7,120
Region 4		b
Region 5	15	117,069
Region 6	5	76,529
Region 7	25	47,071
State	5	253,877[a]
STATE TOTAL, ALL HUNTING	c	13,885,814
Cold Water Fishing,		
Region 1	120	12,720,613
Region 2	40	2,707,965
Region 3	60	1,018,815
Region 4		b
Region 5	25	367,038
Region 6	35	405,316
Region 7	70	563,167
State	40	11,225,685[a]
Warm Water Fishing,		
Region 1	110	751,539
Region 2	45	411,927
Region 3	190	4,719,628
Region 4	25	1,065,400
Region 5	70	13,499,751
Region 6	20	127,397
Region 7	25	1,066,849
State	60	18,832,237[a]
STATE TOTAL, ALL FISHING	c	30,057,922

TABLE 4. (CONT'D) NONDISCRIMINATING MONOPOLIST VALUES.

Activity and Region	Nondiscriminating Monopolist Price ($)	Nondiscriminating Monopolist Value ($)
General Rural Outdoor Recreation,		
Region 1	200	19,368,992
Region 2	200	32,946,847
Region 3	100	2,928,689
Region 4	90	2,138,720
Region 5	60	16,514,449
Region 6	30	10,474,190
Region 7	80	2,751,233
State	60	47,639,237[a]
STATE GRAND TOTAL, ALL ACTIVITIES	c	91,582,973

[a]The nondiscriminating monopolist value for the state for a particular activity is less than the sum of the nondiscriminating monopolist values for each region for that activity (see text, page 14).

[b]Value could not be estimated because of too few observations to develop the statistical demand function. The value can be assumed to be relatively small compared to the other regions which are more heavily used for the particular activity.

[c]Not applicable.

A better understanding of the contents of summary Table 4 may be obtained by examining the detailed data of Tables 5 and 6 which focus only on deer hunting. Table 5 gives, by Region, all the alternative revenues that could have been obtained and the associated numbers of household-trips that would have been made if alternative added costs (entry fees) had been charged in 1970 above the deer hunter's actual variable costs of participation. Table 6 sums the data of Table 5 across Regions to obtain the schedule of trips, prices and values for the whole state. Each of the schedules shown in Tables 5 and 6 are the data from alternative points along the second-stage demand curve for the activity in the given region as described in the previous section on conceptualization of recreation demand.

For example, examine the first section in Table 5 which gives the demand schedule for deer hunting

TABLE 5. ESTIMATES OF RESOURCE VALUES FOR USE IN DEER HUNTING AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Deer Hunting,			
Region 1	0	24,250	0
	5	20,176	100,880
	10	17,484	174,845
	15	14,722	220,833
	20	13,186	263,724
	25	12,083	302,095
	30	11,089	332,673
	35[a]	9,826	343,934[b]
	40	8,420	336,800
	45	6,357	286,103
	50	5,925	296,261
	60	4,063	243,812
	70	1,466	102,654
	74	0	0

in Region 1. In 1970, an estimated 24,250 household trips were made to Region 1 for the purpose of hunting deer. A certain amount of variable expense was associated with these trips, but there was no entry fee to the Region, therefore, added costs were zero. Had there been added costs of $5 per household-trip, imposed either as an entry fee or simply occurring for any other reason associated with making the trip, it is estimated that only 20,176 household-trips would have been made. If the added cost was in the form of a fee, $100,880 would have been collected.

If higher levels of added cost had occurred, the number of trips taken would have been less and less until, if an added cost of $74 per household-trip had occurred, no trips would have been taken. Had the added cost been in the form of an entry fee total revenues could have been maximized at a price of $35 per trip even though the number of trips taken would have been less than at a lower price. In this lower price range, demand for deer hunting in Region I is termed "inelastic"--increasing prices bring greater revenues even though less of the commodity is sold; at prices of more than $35 per household-trip, demand is "elastic"--higher prices would cause fewer trips and lower revenues until trips and revenues would finally fall to zero.

TABLE 5. (CONTINUED)

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Deer Hunting,			
Region 2	0	65,871	0
	5	60,305	301,527
	10	55,955	559,553
	15	51,660	774,901
	20	47,419	948,397
	25	43,234	1,080,867
	30	39,104	1,173,135
	35	35,029	1,226,026
	40	31,959	1,278,368
	45	29,684	1,335,809
	50	27,665	1,383,284
	60[a]	23,896	1,433,769[b]
	70	20,256	1,417,987
	80	17,080	1,366,413
	90	15,398	1,385,870
	100	13,999	1,399,959
	110	12,686	1,396,965
	120	11,437	1,372,509
	130	10,517	1,367,291
	140	9,773	1,368,284
	150	9,103	1,365,570
	160	8,464	1,354,247
	170	7,805	1,327,005
	180	7,328	1,319,129
	190	6,905	1,312,020
	200	6,500	1,300,043
	250	5,142	1,285,710
	300	4,454	1,110,000
	350	4,028	1,000,000
	400	3,856	900,000
	439	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 5. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Deer Hunting, Region 3	0	12,718	0
	5	10,824	54,124
	10	8,953	89,535
	15	7,792	116,893
	20	6,936	138,739
	25	6,182	154,557
	30	4,497	134,911
	35	4,195	146,841
	40	3,895	155,824
	45[a]	3,542	159,394[b]
	50	2,976	148,814
	60	1,581	94,894
	70	0	0

The highest total revenue obtainable with its associated price is termed the nondiscriminating monopolist value of the resource and the nondiscriminating monopolist price, respectively.5/

The remaining sections of Table 5 give analogous information about deer hunting in each of the other six Regions in the state. Note that the estimates of total revenue do not necessarily first rise and then fall in a smooth curve. Rather, revenue may rise, then fall, and then rise and fall again one or more times before finally falling to zero. For example, in Region 5, revenue rises smoothly to a monopolist value of $157,037 at an added cost of $15. At an added cost of $20 total revenue falls to $146,379 but, as price rises farther to $25, total revenue again rises to $149,116, then falls and rises once more before declining to zero with a price of $68.

5/ Since estimates are recorded at minimum intervals of $5 of added cost rather than at smaller intervals, the absolute maximum revenue obtainable could be within a one or two dollar interval about the $35 price shown. Intervals shown are $5 up to an added cost of $50, $10 intervals up to an added cost of $200 and $50 intervals thereafter.

TABLE 5. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Deer Hunting, Region 4	0	7,582	0
	5	7,014	35,074
	10	6,569	65,692
	15	6,117	91,755
	20	5,658	113,167
	25	5,193	129,830
	30	4,727	141,822
	35	4,288	150,101
	40	3,994	159,786
	45	3,716	167,235
	50	3,434	171,716
	60[a]	2,863	171,813[b]
	70	2,405	168,419
	80	2,089	167,135
	90	1,764	158,807
	100	1,476	147,678
	110	1,270	139,739
	120	1,059	127,098
	130	903	117,427
	140	790	110,697
	150	675	101,348
	160	558	89,306
	170	438	74,498
	180	315	56,498
	190	191	36,290
	200	78	15,634
	241	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 5. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Deer Hunting, Region 5	0	31,959	0
	5	21,993	109,968
	10	14,658	146,589
	15[a]	10,469	157,037[b]
	20	7,318	146,379
	25	5,964	149,116
	30	4,937	148,114
	35	4,210	147,381
	40	3,438	137,526
	45	2,830	127,359
	50	2,651	132,590
	60	2,319	139,179
	68	0	0
Deer Hunting, Region 6	0	38,304	0
	5	34,342	171,710
	10	31,497	314,971
	15	28,801	432,024
	20	26,030	520,603
	25	23,631	590,776
	30	21,813	654,413
	35	20,443	715,539
	40	19,207	768,284
	45	18,067	813,057
	50	17,064	853,214
	60	15,176	910,577
	70	13,913	973,945
	80	12,634	1,010,753
	90	10,584	952,630
	100[a]	10,148	1,014,809[b]
	110	8,206	902,746
	118	0	0

TABLE 5. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Deer Hunting, Region 7	0	32,128	0
	5	29,231	146,157
	10	27,033	270,338
	15	24,828	372,431
	20	22,797	455,945
	25	20,848	521,216
	30	18,982	569,487
	35	17,200	602,010
	40	15,705	628,235
	45	14,590	656,561
	50	13,666	683,344
	60	12,050	723,020
	70	10,471	732,989
	80	9,284	742,761
	90	8,312	748,146
	100	7,634	763,470
	110	7,036	773,997
	120[a]	6,715	805,902[b]
	130	6,006	780,789
	140	5,260	736,494
	150	3,566	534,939
	160	241	38,580
	161	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 6. THE VALUE OF DEER HUNTING IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	212,812	0	All
5	183,885	919,440	All
10	162,149	1,621,523	All
15	144,389	2,165,874	All
20	129,344	2,586,954	All
25	117,135	2,928,947	All
30	105,149	3,154,555	All
35	95,191	3,331,832	All
40	86,618	3,464,823	All
45	78,786	3,545,518	All
50	73,381	3,669,223	All
60[a]	61,948	3,717,064[b]	All
70	48,511	3,395,994	1, 2, 4, 6, 7
80	41,087	3,287,062	2, 4, 6, 7
90	36,058	3,245,453	2, 4, 6, 7
100	33,257	3,325,916	2, 4, 6, 7
110	29,198	3,213,447	2, 4, 6, 7
120	19,211	2,305,509	2, 4, 7
130	17,426	2,265,507	2, 4, 7
140	15,823	2,215,475	2, 4, 7
150	13,344	2,001,857	2, 4, 7
160	9,263	1,482,133	2, 4, 7
170	8,484	1,401,503	2, 4
180	7,643	1,375,979	2, 4
190	7,096	1,348,310	2, 4
200	6,578	1,315,677	2, 4
250	5,142	1,285,710	2
300	4,454	1,110,000	2
350	4,028	1,000,000	2
400	3,856	900,000	2
439	0	0	none

[a] Nondiscriminating monopolist price for deer hunting in the state.

[b] Nondiscriminating monopolist value for deer hunting in the state.

The explanation is that at certain levels of price, large blocks of households would cease making trips and revenue would fall. Then, for slightly greater price increases, the remaining households are less responsive to price increases and the demand schedule again becomes inelastic. Finally, some of the remaining households drop the activity in the Region and revenues again fall.6/

A more striking example of this "roller coaster" effect on total revenue is shown for deer hunting in Region 6. A nondiscriminating monopolist value of $1,014,809 with an associated price of $100 per household-trip is marked on Table 5. Yet, it is seen that an estimate of $1,010,753, essentially the same value, is shown at a price of $80 where more trips are taken. Where two values are almost identical it is possibly more reasonable to select the value at the lower price as the nondiscriminating monopolist value, since because of errors in estimation no value is precisely true, and selection of the value at the lower price is the more "conservative" decision.7/

The estimate for the nondiscriminating monopolist value for deer hunting for the state, as shown in Table 4 and Table 6, is not simply the sum of the values for individual Regions. Rather, the statewide value is determined by horizontally summing the seven regional demand schedules (as shown in Table 5), at each increment of added cost, to give a single statewide demand schedule as shown in Table 6. The maximum value for total revenue on the statewide schedule, $3,717,064 at a price of $60, is the nondiscriminating monopolist value for the state. The value for the state is lower than the sum of the nondiscriminating monopolist values for all Regions contained within the state. The reason is that if different "added costs" were charged for each Region, a larger revenue could be extracted than if only a single price were charged at the state level. Obviously, a larger total return can be obtained if one discriminated between Regions rather than charge a single price for the whole state.8/

6/ The "roller coaster" shape of the aggregate demand curve is formed by the horizontal summation of the individual curvilinear demand curves.

7/ Choosing the lower value is "conservative" in terms of guarding against over-allocation of resources to recreation. It may be a "liberal" choice in terms of other resource uses.

8/ The problem of nonadditivity does not arise with consumer surplus values.

All seven Regions are still receiving deer hunting visits at the $60 statewide nondiscriminating monopolist price per household visit (see Table 6). At an added cost of $70, deer hunters would no longer hunt Regions 3 and 5. As added costs per trip rise further, trips and total revenues fall until finally at added costs per trip of $250 or more (see Region 4 in Table 5 and Table 6), only Region 2 would be hunted.

Details behind the summary estimates of Table 4 are presented in Tables 7 and 8 for other big game hunting, Tables 9 and 10 for small game hunting, Tables 11 and 12 for waterfowl hunting, Tables 13 and 14 for general hunting, Tables 15 and 16 for cold water fishing, Tables 17 and 18 for warm water fishing, and Tables 19 and 20 for general rural outdoor recreation. These tables are all presented at the end of this section without interspersing text. Interpretation of these tables is analogous to the interpretation of Table 5 and 6 as explained above. However, discussion of several discrepancies are in order.

In Tables 7, 16 and 20, rather extreme examples of the "roller coaster" effect discussed above occur. In each case one of the lower high-points on the total revenue schedule has been chosen as the "most reasonable" estimate of the nondiscriminating monopolist value. In Table 7, the problem occurs for hunting big game (other than deer) in Region 1. Even though the absolute high-point in revenue has been rejected as the most reasonable value of the resource, there is a reasonable explanation for the bimodal distribution of values. Region 1 is one of the best areas for big game hunting. It is very popular. Therefore, relatively heavy participation in hunting is found even at the $70 added cost chosen as the most reasonable level for the nondiscriminating monopolist value. But, revenue falls very little thereafter as added costs continue to rise and finally revenue rises to the highest point at a $650 price just before trips fall to zero. It is implied that response to price becomes very inelastic for the small number of households participating at the higher added costs. These households would hunt other big game in this Region at almost any price. In fact, such behavior probably would be true of a small number of households, and a small number of households was found in the sample that took a large number of big game trips to this Region in 1970 from relatively great distances at quite high actual variable costs. Thus, while the estimate at the higher level of added cost is not totally unreasonable, the estimate at the lower level of added cost is selected as "most reasonable" simply because it is more conservative.

In Tables 16 and 20, the roller coaster effect shows up in the estimates of value for the whole state, rather than in the value of a Region as discussed above. In both cases, the maximum value is at a very high added cost, but after visits to most Regions (the less favorable areas) would have ceased. Again, the higher values are conceptually possible but the lower values were selected as "most reasonable" because all Regions for which estimates are available are represented in the estimates of cold water fishing in Table 16 and all Regions except one remain in the nondiscriminating monopolist estimate for the value of general rural outdoor recreation in Table 20.

The discussion thus far has focused on the single nondiscriminating monopolist value and price for the Region or state. It is obvious, however, that since Tables 5 through 20 are complete demand schedules, the tables could have broader usage. For example, the number of hunting visits to a Region could be regulated by charging the appropriate fee rather than by the current 1974 approach of issuing permits. An obvious advantage of this approach would be that it would make money for the regulatory agency rather than simply creating administrative costs as does the present system. The size of the fee would depend on the number of hunters desired in the area. Reading from Table 7, one sees that 21,087 household-visits were made to Region 1 for the purpose of hunting other big game in 1970 when no fee was charged. If only 19,631 household-visits were desired, a higher fee could be charged. Since regulation is usually desired by Management Unit rather than simply by the larger Management Regions, the agency would need to do some experimenting with the size of the fees, charging more in the more desirable units or where fewer visits were desired and charging less in units receiving less hunting pressure. One would not expect that a fee as large as the nondiscriminating monopolist price would ever be charged under such a system.

TABLE 7. ESTIMATES OF RESOURCE VALUES FOR USE IN BIG GAME HUNTING AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Big Game Hunting,			
Region 1	0	21,087	0
	5	19,631	98,159
	10	18,260	182,604
	15	16,899	253,498
	20	15,550	311,008
	25	14,211	355,297
	30	12,884	386,530
	35	11,567	404,871
	40	10,262	410,486
	45	9,325	419,630
	50	8,759	437,974
	60	7,791	467,504
	70[a]	6,855	479,857[b]
	80	5,936	474,949
	90	5,120	460,863
	100	4,656	465,660
	110	4,227	464,971
	120	3,805	456,651
	130	3,391	440,940
	140	3,043	426,063
	150	2,841	426,282
	160	2,653	424,583
	170	2,469	419,778
	180	2,288	411,982
	190	2,129	404,691
	200	2,002	400,460
	250	1,582	395,584
	300	1,337	401,206
	350	1,203	421,100
	400	1,091	436,713
	450	1,019	458,924
	500	963	481,635
	550	924	508,696
	600	901	540,906
	650	834	542,117[c]
	668	0	0

TABLE 7. (CONTINUED)

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Big Game Hunting,			
Region 2	0	24,377	0
	5	21,016	105,083
	10	18,847	188,478
	15	16,817	252,269
	20	14,936	298,724
	25	13,544	338,610
	30	12,467	374,029
	35	11,633	407,176
	40	10,912	436,495
	45	10,168	457,568
	50[a]	9,307	465,367[b]
	60	5,831	349,917
	70	5,328	373,012
	80	4,682	374,560
	90	3,932	353,900
	100	3,449	344,982
	110	187	20,665
	111	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

[c] Although this value is the largest total revenue and thus technically the nondiscriminating monopolist value, it has been rejected as unreasonable. The alternate high point at an added cost of $70 is used. See discussion in the text.

TABLE 7. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Big Game Hunting,			
Region 5	0	25,919	0
	5	24,733	123,669
	10	23,629	236,293
	15	22,570	338,564
	20	21,558	431,173
	25	20,592	514,812
	30	19,672	590,173
	35	18,798	657,947
	40	17,970	718,825
	45	17,188	773,500
	50	16,453	822,663
	60	15,120	907,220
	70	13,848	969,375
	80	13,223	1,057,870
	90	12,147	1,093,235
	100	11,757	1,175,790
	110	10,759	1,183,567
	120	9,783	1,174,018
	130[a]	9,246	1,202,048[b]
	140	3,293	461,158
	149	0	0
Big Game Hunting,			
Region 6	0	22,944	0
	5	20,523	102,615
	10	18,587	185,873
	15	16,641	249,621
	20	14,944	298,881
	25	12,647	316,183
	30	10,620	318,602
	35	9,975	349,133
	40[a]	9,218	368,744[b]
	45	5,970	268,687
	50	5,116	255,844
	60	0	0

TABLE 7. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Big Game Hunting,			
Region 7	0	10,570	0
	5	8,742	43,711
	10	6,626	66,262
	15	5,129	76,948
	20	4,277	85,547
	25	3,632	90,818
	30	3,110	93,313
	35	2,735	95,727
	40	2,510	100,416
	45	2,318	104,345
	50	2,028	101,420
	60[a]	1,809	108,543[b]
	70	1,155	80,891
	80	857	68,575
	85	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 8. THE VALUE OF BIG GAME HUNTING IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	104,898	0	1, 2, 5, 6, 7
5	94,645	473,237	1, 2, 5, 6, 7
10	85,949	859,510	1, 2, 5, 6, 7
15	78,056	1,170,900	1, 2, 5, 6, 7
20	71,265	1,425,333	1, 2, 5, 6, 7
25	64,626	1,615,720	1, 2, 5, 6, 7
30	58,753	1,762,647	1, 2, 5, 6, 7
35	54,708	1,914,854	1, 2, 5, 6, 7
40[a]	50,872	2,034,966[b]	1, 2, 5, 6, 7
45	44,969	2,023,730	1, 2, 5, 6, 7
50	41,663	1,981,848	1, 2, 5, 6, 7
60	30,551	1,833,184	1, 2, 5, 7
70	27,186	1,903,135	1, 2, 5, 7
80	24,698	1,975,954	1, 2, 5, 7
90	21,199	1,907,998	1, 2, 5
100	19,862	1,986,432	1, 2, 5
110	15,173	1,669,203	1, 2, 5
120	13,588	1,630,669	1, 5
130	12,637	1,642,988	1, 5
140	6,336	887,221	1, 5
150	2,841	426,282	1
160	2,653	424,583	1
170	2,469	419,778	1
180	2,288	411,982	1
190	2,219	404,691	1
200	2,002	400,460	1
250	1,582	395,584	1
300	1,337	401,206	1
350	1,203	421,100	1
400	1,091	436,713	1
450	1,019	458,924	1
500	963	481,635	1
550	924	508,696	1
600	901	540,906	1
650	834	542,117	1
668	0	0	none

[a] Nondiscriminating monopolist price for the state.

[b] Nondiscriminating monopolist value for the state.

TABLE 9. ESTIMATES OF RESOURCE VALUES FOR USE IN SMALL GAME HUNTING AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Small Game Hunting, Region 1	0	14,097	0
	5	5,761	28,808
	10	3,771	37,716
	15[a]	3,227	45,185[b]
	20	480	9,601
	22	0	0
Small Game Hunting, Region 2	0	29,163	0
	5	18,925	94,629
	10	13,726	137,265
	15	10,943	164,153
	20	9,099	181,995
	25	7,876	196,901
	30	6,816	204,508
	35	5,975	209,156
	40	5,233	209,323
	45[a]	4,783	215,256[b]
	50	3,669	183,464
	53	0	0
Small Game Hunting, Region 3	0	14,156	0
	5	8,986	44,934
	10	6,808	68,080
	15	5,690	85,351
	20[a]	4,492	89,846[b]
	25	1,055	26,396
	28	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 9. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Small Game Hunting,			
Region 4	0	70,283	0
	5	49,170	245,851
	10	37,867	378,676
	15	31,067	466,011
	20	26,455	529,118
	25	23,235	580,875
	30	20,889	626,696
	35	19,087	668,064
	40	18,017	720,682
	45[a]	16,803	756,155[b]
	50	12,447	622,387
	58	0	0
Small Game Hunting			
Region 5	0	264,832	0
	5	210,540	1,052,702
	10	171,490	1,714,906
	15	144,807	2,172,110
	20	126,081	2,521,630
	25	112,922	2,823,069
	30	103,089	3,092,691
	35	95,996	3,359,885
	40	88,493	3,539,759
	45	81,589	3,671,544
	50[a]	77,370	3,868,521[b]
	59	0	0

TABLE 9. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Small Game Hunting,			
Region 6	0	176,962	0
	5	141,981	709,908
	10	119,238	1,192,388
	15	102,668	1,540,031
	20	91,438	1,828,779
	25	84,178	2,104,465
	30	78,808	2,364,248
	35[a]	73,140	2,559,916[b]
	40	52,233	2,089,358
	45	21,797	980,900
	48	0	0
Small Game Hunting,			
Region 7	0	85,516	0
	5	64,201	321,009
	10	51,579	515,790
	15	42,838	642,577
	20	36,949	738,986
	25	32,582	814,569
	30	29,573	887,193
	35	27,299	955,474
	40	24,809	992,394
	45[a]	23,453	1,055,389[b]
	50	18,593	929,693
	60	727	43,670
	61	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 10. THE VALUE OF SMALL GAME HUNTING IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	655,009	0	All
5	499,564	2,497,841	All
10	404,479	4,044,821	All
15	341,240	5,115,418	All
20	294,994	5,899,955	All
25	261,848	6,546,275	2,3,4,5,6,7
30	239,175	7,175,336	2,4,5,6,7
35[a]	221,479	7,752,495[b]	2,4,5,6,7
40	188,785	7,551,516	2,4,5,6,7
45	148,425	6,679,244	2,4,5,6,7
50	112,079	5,604,065	2,4,5,7
60	727	43,670	7
61	0	0	none

[a] Nondiscriminating monopolist price for the state.

[b] Nondiscriminating monopolist value for the state.

TABLE 11. ESITMATES OF RESOURCE VALUES FOR USE IN WATERFOWL HUNTING AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Waterfowl Hunting,			
Region 1	0	4,192	0
	5	2,520	12,601
	10	1,770	17,702
	15	1,366	20,500
	20	1,184	23,689
	25[a]	960	24,005[b]
	30	438	13,165
	33	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 11. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Waterfowl Hunting,			
Region 2	0	4,648	0
	5	1,791	8,955
	10[a]	1,114	11,144[b]
	15	361	5,421
	17	0	0
Waterfowl Hunting,			
Region 4	0	17,633	0
	5	8,606	43,030
	10	4,823	48,230
	15	3,241	48,615
	20[a]	2,824	56,499[b]
	25	1,360	34,005
	29	0	0
Waterfowl Hunting,			
Region 7	0	8,566	0
	5	5,507	27,539
	10	4,104	41,046
	15	2,913	43,699
	20[a]	2,361	47,224[b]
	25	1,043	26,088
	30	822	24,660
	35	758	26,547
	40	170	6,806
	43	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 12. THE VALUE OF WATERFOWL HUNTING IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	35,039	0	1, 2, 4, 7
5	18,424	92,125	1, 2, 4, 7
10	11,811	118,122	1, 2, 4, 7
15	7,881	118,235	1, 2, 4, 7
20[a]	6,369	127,412[b]	1, 4, 7
25	3,363	84,098	1, 4, 7
30	1,260	37,825	1, 7
35	758	26,547	7
40	170	6,806	7
43	0	0	none

[a] Nondiscriminating monopolist price for the state.

[b] Nondiscriminating monopolist value for the state.

TABLE 13. ESTIMATES OF RESOURCE VALUES FOR USE IN GENERAL HUNTING AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
General Hunting,			
Region 1	0	7,261	0
	5	4,460	22,302
	10	3,179	31,796
	15	2,660	39,910
	20[a]	2,373	47,466[b]
	25	1,470	36,771
	30	852	25,560
	32	0	0
General Hunting,			
Region 2	0	20,96[illegible]	0
	5	2,702	13,512
	10[a]	1,945	19,454[b]
	12	0	0

TABLE 13. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
General Hunting,			
Region 3	0	4,982	0
	5[a]	1,424	7,120[b]
	10	349	3,491
	11	0	0
General Hunting,			
Region 5	0	50,951	0
	5	21,372	106,863
	10	10,686	106,860
	15[a]	7,804	117,069[b]
	20	4,618	92,371
	25	1,262	31,560
	27	0	0
General Hunting,			
Region 6	0	31,794	0
	5[a]	15,305	76,529[b]
	10	3,833	38,330
	13	0	0
General Hunting,			
Region 7	0	11,912	0
	5	5,510	27,551
	10	3,742	37,427
	15	2,719	40,791
	20	2,143	42,868
	25[a]	1,882	47,071[b]
	30	1,203	36,097
	31	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 14. THE VALUE OF GENERAL HUNTING IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	127,862	0	1,2,3,5,6,7
5[a]	50,773	253,877[b]	1,2,3,5,6,7
10	23,734	237,358	1,2,3,5,6,7
15	13,183	197,770	1, 5, 7
20	9,134	182,705	1, 5, 7
25	4,614	115,402	1, 5, 7
30	2,055	61,657	1, 7
32	0	0	none

[a] Nondiscriminating monopolist price for the state.

[b] Nondiscriminating monopolist value for the state.

TABLE 15. ESTIMATES OF RESOURCE VALUES FOR USE IN COLD WATER FISHING AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Cold Water Fishing,			
Region 1	0	279,050	0
	5	256,001	1,280,006
	10	237,278	2,372,780
	15	219,736	3,296,040
	20	206,123	4,122,478
	25	194,615	4,865,395
	30	183,515	5,505,476
	35	174,943	6,123,013
	40	167,455	6,698,216
	45	160,802	7,236,102
	50	154,477	7,723,860
	60	145,047	8,702,829
	70	132,368	9,265,765
	80	126,271	10,101,703
	90	120,786	10,870,793
	100	115,051	11,505,195
	110	110,156	12,117,228
	120[a]	106,005	12,720,613[b]
	130	91,662	11,916,175
	140	41,850	5,859,054
	150	25,249	3,787,361
	160	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 15. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Cold Water Fishing, Region 2	0	179,869	0
	5	148,885	744,427
	10	124,914	1,249,147
	15	107,037	1,605,561
	20	94,648	1,892,961
	25	83,468	2,086,717
	30	75,415	2,262,452
	35	70,393	2,463,789
	40[a]	67,699	2,707,965[b]
	45	41,828	1,882,299
	50	33,010	1,650,543
	60	20,133	1,208,003
	64	0	0
Cold Water Fishing, Region 3	0	38,792	0
	5	32,526	162,634
	10	28,722	287,228
	15	26,089	391,344
	20	23,652	473,048
	25	22,170	554,259
	30	20,926	627,787
	35	19,849	694,729
	40	19,039	761,596
	45	18,323	824,550
	50	17,730	886,524
	60[a]	16,980	1,018,815[b]
	70	13,408	938,577
	80	0	0

TABLE 15. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Cold Water Fishing, Region 5	0	44,003	0
	5	32,688	163,440
	10	24,950	249,501
	15	20,095	301,428
	20	16,969	339,399
	25[a]	14,681	367,038[b]
	30	9,420	282,615
	35	8,609	301,326
	40	7,710	308,424
	45	6,440	289,805
	50	5,147	257,377
	60	77	4,666
	61	0	0
Cold Water Fishing, Region 6	0	31,579	0
	5	25,412	127,061
	10	21,228	212,282
	15	18,696	280,453
	20	15,897	317,955
	25	12,859	321,489
	30	12,329	369,896
	35[a]	11,580	405,316[b]
	40	8,673	346,948
	44	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 15. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Cold Water Fishing,			
Region 7	0	28,417	0
	5	20,322	101,613
	10	16,184	161,848
	15	13,640	204,608
	20	12,250	245,000
	25	11,390	284,757
	30	10,755	322,667
	35	10,369	362,926
	40	10,063	402,536
	45	9,829	442,341
	50	9,312	465,635
	60	9,074	544,471
	70[a]	8,045	563,167[b]
	74	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 16. THE VALUE OF COLD WATER FISHING IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	601,710	0	1,2,3,5,6,7
5	515,834	2,579,181	1,2,3,5,6,7
10	453,276	4,532,786	1,2,3,5,6,7
15	405,293	6,079,434	1,2,3,5,6,7
20	369,539	7,390,841	1,2,3,5,6,7
25	339,183	8,479,655	1,2,3,5,6,7
30	312,360	9,370,893	1,2,3,5,6,7
35	295,743	10,351,099	1,2,3,5,6,7
40[a]	280,639	11,225,685[b]	1,2,3,5,6,7
45	237,222	10,675,097	1,2,3,5,7
50	219,676	10,983,939	1,2,3,5,7
60	191,311	11,478,784[c]	1,2,3,5,7
70	153,821	10,767,509	1, 3, 7
80	126,271	10,101,703	1
90	120,786	10,870,793	1
100	115,051	11,505,195	1
110	110,156	12,117,228	1
120	106,005	12,720,613[d]	1
130	91,662	11,916,175	1
140	41,850	5,859,054	1
150	25,249	3,787,361	1
160	0	0	none

[a] Nondiscriminating monopolist price for the state.

[b] Nondiscriminating monopolist value for the state.

[c] Although this value is the largest total revenue and thus technically the nondiscriminating monopolist value, it has been rejected as unreasonable. One of the alternate high points at the added cost of $40 is used. See discussion in the text.

[d] This value is the second highest total revenue but has been rejected as the most reasonable nondiscriminating monopolist value since it is not significantly different from the value at an added cost of $40, and Region 6 is not included.

TABLE 17. ESTIMATES OF RESOURCE VALUES FOR USE IN WARM WATER FISHING AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Warm Water Fishing, Region 1	0	20,503	0
	5	18,335	91,678
	10	16,674	166,745
	15	15,163	227,456
	20	14,056	281,132
	25	13,060	326,502
	30	12,248	367,453
	35	11,602	406,094
	40	11,161	446,449
	45	9,880	444,634
	50	9,548	477,447
	60	8,392	503,533
	70	8,023	561,663
	80	7,495	599,607
	90	7,081	637,314
	100	6,941	694,198
	110[a]	6,832	751,539[b]
	120	6,113	733,646
	130	3,595	467,436
	140	542	75,990
	141	0	0
Warm Water Fishing, Region 2	0	32,959	0
	5	19,725	98,625
	10	15,228	152,287
	15	12,800	192,011
	20	11,691	233,826
	25	10,986	274,658
	30	10,548	316,468
	35	9,890	346,155
	40	9,712	388,486
	45[a]	9,153	411,927[b]
	50	4,836	241,849
	52	0	0

TABLE 17. (CONT'D)

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Warm Water Fishing, Region 3	0	55,347	0
	5	50,548	252,741
	10	47,735	477,351
	15	45,432	681,482
	20	43,494	869,890
	25	41,731	1,043,285
	30	40,193	1,205,799
	35	38,799	1,357,994
	40	37,479	1,499,162
	45	36,246	1,631,085
	50	35,187	1,759,391
	60	33,594	2,015,657
	70	32,300	2,261,046
	80	31,135	2,490,856
	90	30,060	2,705,480
	100	29,105	2,910,529
	110	28,247	3,107,250
	120	27,472	3,296,723
	130	26,823	3,487,114
	140	26,300	3,682,057
	150	25,875	3,881,291
	160	25,516	4,082,630
	170	25,223	4,288,063
	180	24,997	4,499,578
	190[a]	24,840	4,719,628[b]
	200	21,893	4,378,779
	216	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 17. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Warm Water Fishing,			
Region 4	0	83,284	0
	5	67,294	336,470
	10	57,751	577,516
	15	51,682	775,237
	20	47,703	954,078
	25[a]	42,616	1,065,400[b]
	30	30,031	900,955
	35	0	0
Warm Water Fishing,			
Region 5	0	405,535	0
	5	365,156	1,825,781
	10	331,907	3,319,073
	15	304,732	4,570,981
	20	287,735	5,680,116
	25	267,175	6,679,381
	30	255,561	7,411,293
	35	240,799	8,427,983
	40	231,112	9,244,510
	45	223,028	10,036,272
	50	216,458	10,822,946
	60	205,217	12,313,047
	70[a]	192,853	13,499,751[b]
	80	165,072	13,205,778
	90	25,505	2,295,481
	94	0	0
Warm Water Fishing,			
Region 6	0	20,503	0
	5	14,497	72,487
	10	10,047	100,479
	15	8,221	123,321
	20[a]	6,369	127,397[b]
	25	3,806	95,152
	30	273	8,218
	31	0	0

TABLE 17. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
Warm Water Fishing,			
Region 7	0	125,138	0
	5	93,217	466,086
	10	71,969	719,690
	15	62,208	933,121
	20	53,290	1,065,800
	25[a]	42,673	1,066,849[b]
	30	19,713	591,400
	35	11,418	399,652
	40	5,701	228,070
	44	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 18. THE VALUE OF WARM WATER FISHING IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	743,269	0	All
5	628,772	3,143,868	All
10	551,311	5,513,136	All
15	500,238	7,503,609	All
20	464,338	9,212,239	All
25	422,047	10,551,227	All
30	368,567	10,801,586	All
35	312,508	10,949,296	1, 2, 3, 5, 7
40	295,165	11,806,677	1, 2, 3, 5, 7
45	278,307	12,523,918	1, 2, 3, 5
50	266,029	13,361,633	1, 2, 3, 5
60[a]	247,203	18,832,237[b]	1, 3, 5
70	233,176	16,322,460	1, 3, 5
80	203,702	16,296,241	1, 3, 5
90	62,646	5,638,275	1, 3
100	36,046	3,604,727	1, 3
110	35,079	3,858,789	1, 3
120	33,585	4,030,369	1, 3
130	30,418	3,954,550	1, 3
140	26,842	3,758,047	1, 3
150	25,875	3,881,291	3
160	25,516	4,082,630	3
170	25,223	4,288,063	3
180	24,997	4,499,578	3
190	24,840	4,719,628	3
200	21,893	4,378,779	3
216	0	0	none

[a] Nondiscriminating monopolist price for the state.

[b] Nondiscriminating monopolist value for the state.

TABLE 19. ESTIMATES OF RESOURCE VALUES FOR USE IN GENERAL RURAL OUTDOOR RECREATION AT ALTERNATIVE ADDED COSTS, BY GAME AND FISH REGIONS, 1970.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
General Rural Outdoor Recreation			
Region 1	0	224,943	0
	5	197,247	986,236
	10	192,161	1,921,613
	15	187,194	2,807,922
	20	182,347	3,646,956
	25	177,620	4,440,504
	30	172,795	5,183,852
	35	168,294	5,890,303
	40	163,287	6,531,490
	45	159,035	7,156,608
	50	154,902	7,745,134
	60	146,694	8,801,679
	70	139,255	9,747,915
	80	132,348	10,587,847
	90	127,424	11,468,199
	100	123,426	12,342,621
	110	120,202	13,222,290
	120	116,950	14,034,098
	130	111,751	14,527,711
	140	109,531	15,334,458
	150	106,836	16,025,456
	160	104,888	16,782,142
	170	103,254	17,553,253
	180	101,937	18,348,769
	190	98,766	18,765,615
	200[a]	96,844	19,368,992[b]
	250	37,539	9,384,969
	264	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 19. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
General Rural Outdoor Recreation, Region 2	0	464,093	0
	5	403,285	2,016,429
	10	387,574	3,875,741
	15	372,211	5,583,170
	20	357,116	7,142,339
	25	342,452	8,561,300
	30	328,135	9,844,076
	35	314,168	10,995,898
	40	300,682	12,027,315
	45	290,310	13,063,964
	50	281,451	14,072,551
	60	265,388	15,923,317
	70	250,603	17,542,221
	80	236,593	18,927,470
	90	223,921	20,152,922
	100	214,708	21,470,871
	110	206,684	22,735,319
	120	199,445	23,933,430
	130	193,226	25,119,509
	140	187,658	26,272,257
	150	182,267	27,340,053
	160	177,855	28,456,934
	170	173,718	29,532,135
	180	169,987	30,597,673
	190	167,325	31,791,788
	200[a]	164,734	32,946,847[b]
	250	74,669	18,667,340
	262	0	0

TABLE 19. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
General Rural Outdoor Recreation, Region 3	0	95,174	0
	5	71,706	358,532
	10	62,736	627,360
	15	56,343	845,147
	20	51,415	1,028,318
	25	47,897	1,197,449
	30	45,396	1,361,890
	35	43,190	1,511,660
	40	41,235	1,649,400
	45	39,544	1,779,508
	50	38,106	1,905,335
	60	35,718	2,143,090
	70	33,696	2,358,759
	80	32,057	2,564,603
	90	30,830	2,774,771
	100[a]	29,286	2,928,689[b]
	110	26,042	2,864,678
	120	17,299	2,075,967
	128	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the actitivy in the region.

TABLE 19. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
General Rural Outdoor Recreation,			
Region 4	0	103,890	0
	5	72,517	362,586
	10	62,302	623,022
	15	54,773	821,605
	20	49,135	982,711
	25	41,884	1,047,115
	30	38,853	1,165,596
	35	36,414	1,274,511
	40	34,310	1,372,419
	45	32,536	1,464,139
	50	30,961	1,548,058
	60	28,520	1,711,238
	70	26,154	1,830,804
	80	24,919	1,993,529
	90[a]	23,763	2,138,720[b]
	100	18,795	1,879,535
	106	0	0
General Rural Outdoor Recreation,			
Region 5	0	737,094	0
	5	599,680	2,998,400
	10	552,333	5,523,338
	15	507,260	7,608,912
	20	477,566	9,551,338
	25	450,609	11,265,230
	30	429,032	12,870,968
	35	412,181	14,426,354
	40	394,333	15,773,354
	45	362,043	16,291,945
	50	328,754	16,437,702
	60[a]	275,240	16,514,449[b]
	70	16,168	1,131,822
	73	0	0

TABLE 19. (CONT'D) RESOURCE VALUES AT ALTERNATIVE ADDED COSTS.

Activity and Region	Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)
General Rural Outdoor Recreation,			
Region 6	0	599,533	0
	5	499,198	2,495,993
	10	463,962	4,639,628
	15	438,217	6,573,256
	20	411,607	8,232,145
	25	380,481	9,512,035
	30[a]	349,139	10,474,190[b]
	35	122,804	4,298,157
	39	0	0
General Rural Outdoor Recreation,			
Region 7	0	160,106	0
	5	123,616	618,082
	10	104,362	1,043,623
	15	91,080	1,366,205
	20	80,323	1,606,479
	25	71,825	1,795,647
	30	65,238	1,957,146
	35	59,547	2,084,168
	40	54,912	2,196,519
	45	51,326	2,309,703
	50	47,980	2,399,034
	60	42,424	2,545,464
	70	38,868	2,720,767
	80[a]	34,390	2,751,233[b]
	90	24,022	2,162,030
	98	0	0

[a] Nondiscriminating monopolist price for the activity in the region.

[b] Nondiscriminating monopolist value for the activity in the region.

TABLE 20. THE VALUE OF GENERAL RURAL OUTDOOR RECREATION IN ARIZONA AT ALTERNATIVE ADDED COSTS, 1970.

Added Cost Per Trip ($)	Number of Trips	Total Revenue ($)	Regions Included at the Given Added Cost
0	2,384,833	0	All
5	1,967,249	9,836,258	All
10	1,825,430	18,254,325	All
15	1,707,078	25,606,217	All
20	1,609,509	32,190,286	All
25	1,512,768	37,819,280	All
30	1,428,588	42,857,718	All
35	1,156,598	40,481,051	All
40	988,759	39,550,497	1,2,3,4,5,7
45	934,794	42,065,867	1,2,3,4,5,7
50	882,154	44,107,814	1,2,3,4,5,7
60[a]	793,984	47,639,237[b]	1,2,3,4,5,7
70	504,744	35,332,288	1,2,3,4,5,7
80	460,310	36,824,682	1,2,3,4,7
90	429,960	38,696,642	1,2,3,4,7
100	386,215	38,621,716	1,2,3,4
110	352,928	38,822,287	1,2,3
120	333,694	40,043,495	1,2,3
130	304,977	39,647,220	1,2
140	297,189	41,606,715	1,2
150	289,103	43,365,509	1,2
160	282,743	45,239,076	1,2
170	276,972	47,085,388	1,2
180	271,924	48,946,442	1,2
190	266,091	50,557,403	1,2
200	261,578	52,315,839[c]	1,2
250	112,208	28,052,309	1,2
264	0	0	none

[a] Nondiscriminating monopolist price for the state.

[b] Nondiscriminating monopolist value for the state.

[c] Although this value is the largest total revenue and thus technically the nondiscriminating monopolist value, it has been rejected as unreasonable. The alternative high point at an added cost of $60 is used. See discussion in the text.

RESOURCE VALUES IN ALTERNATIVE USES

The analysis revealed that in Arizona 4,905,384 household-trips were made by Arizona residents for purposes of rural outdoor recreation generating $243,236,558 of consumer surplus value in 1970. This value represents the total net benefits of the state's natural resources in use for outdoor recreation by Arizona residents (Table 3).

The nondiscriminating monopolist method provides the maximum total revenue that could be extracted at a single price as set by an agency such as the Arizona Game and Fish Department. The monopolist price for 1970 was found to vary from about $5 per household-trip for general hunting to about $60 per household-trip for deer hunting, warm water fishing, and general rural outdoor recreation activities when a price was selected for the state as a whole (Table 4). The total nondiscriminating monopolist value of the state's natural resources in use for outdoor recreation by Arizona residents was $91,582,973.

It is not suggested that the administrative agencies should raise fees to the point where revenue is maximized. There are serious equity considerations that should be made before any increases in fees could be justified. However, the nondiscriminating monopolist value gives a resource value that may be compared to values of alternative products of the land resource if decisions relative to competing uses must be made.

The significance of this study is the role it can play in developing public land policies. Hunting, fishing and general rural outdoor recreation represent only three of the possible uses of the forest, range land, and water resources in Arizona. Other alternatives include such uses as timber production, water production, and cattle grazing on the forest lands, water production and grazing on the desert ranges, and agricultural, municipal and industrial uses of the water.

Often these uses of the resource are unrelated or complementary to each other. In these cases the values of two uses on the same set of resources would be additive--and no problem of decision making about resource use arises. However, sometimes the various uses are competitive, and more of the product of one use can be achieved only at the sacrifice of some of the product of another use.

Where such a multiple-product situation exists on a given resource base, the economic problem becomes one of maximizing the value of output relative to a given cost, i.e., relative to the given resource base. In economic terminology, the product-product relationship must be solved. The solution to this problem involves specifying the substitution relationships between products, at all levels of output of each, specifying the relevant demand function for each product, and then solving for the optimum combination of products to produce. Obviously, the optimum combination of products will change if the relative prices of any two products change.

The general theoretical economic model is quite clear. The problems are in (1) empirically estimating the transformation functions between producing timber, grazing, recreation and water for a given watershed and (2) estimating product demand functions.

Research in estimating product transformation functions for Arizona watersheds is proceding by personnel of the Rocky Mountain Forest and Range Experiment Station and the University of Arizona [for example, see O'Connell and Brown, 1972]. Economic values and/or demand functions for grazing and water are available from past work by Martin and Jefferies [1966] and Kelso, Martin and Mack [1973], respectively. Valuation of timber, forage and water on National Forest Lands are summarized by O'Connell [1972]. This current study contributes demand functions and value estimates for many types of rural outdoor recreation.

THE VALUE OF SURFACE AREA IN ALTERNATIVE RECREATION USES

It is not appropriate to attempt a detailed analysis of the general trade-off problem herein. Rather, the discussion is limited to converting the value estimates presented in the previous section into values per square mile of land (for hunting), values per surface acre of water (for fishing), and values for total surface area for general rural outdoor recreation, in order to better set the value estimates in context with other uses of the land and water resources.

Table 21 presents estimates of the land and water areas available for hunting and fishing in Arizona, classified by Region. Except for the total area of a Region, all figures are "ballpark estimates", but they are the best available. If the value estimates for whole Regions, presented in the previous section, are divided by these estimates of surface area, the data of Table 22 are generated.

The estimates of Table 22 show the average value of a unit of surface area in a particular Region in use for a particular activity in 1970, when valued by the nondiscriminating monopolist procedure. For example, one square mile (one section) of huntable deer range in Region 1 had an average value of $95 in use for hunting deer. At the same time, huntable range for other big game in Region 1, some of which overlaps and some of which is separate from the deer range, was worth $94 per square mile. The weighted average value of all huntable area in Region 1 for all types of hunting was $159 per square mile. The weighted average value for a square mile of all area

TABLE 21. SURFACE AREA OF ARIZONA AVAILABLE FOR RURAL OUTDOOR RECREATION ACTIVITIES, BY REGION AND ACTIVITY, 1970.

Region	Total Area[c]	Huntable Area[a]			Surface Acres[b] of	
		Deer[d]	Other Big Game[d]	All Game[c]	Cold Water[c]	Warm Water[c]
	square miles				surface acres	
1	18,526	3,635	5,100	5,900	5,250	2,470
2	26,182	14,710	11,000	16,900	8,100	6,100
3	11,678	5,270	2,500	8,600	10,000	14,650
4	16,251	6,400	1,800	9,600	-	4,650
5	11,091	9,000	7,565	9,000	2,000	e
6	13,513	5,550	7,500	8,400	250	350
7	16,543	8,850	8,850	13,000	770	38,375[e]
State	113,784	53,415	44,315	71,400	26,370	66,545

[a] Square miles of available hunting area include those areas generally open to the public at all times. There are instances when an area of considerable size may be open for a short duration for a specific hunt, but is normally closed. For instance, the Fort Apache Indian Reservation (2601 sq. mi.) in Region 1 is open for the elk hunt, but closed at other times. Again, in Region 4, the Air Force Bombing Range (2500 sq. mi.) is open for five or so sheep hunters, but is closed the rest of the year.

[b] Surface acreage of water in Arizona includes only that which is inside the Arizona border. The Colorado River Lake area includes only that which is in Arizona. If the total surface acres of Lake Powell, Lake Mead and others were included, the total would be over 300,000 surface acres. Those lakes which are both cold water lakes and warm water lakes have been divided on a percentage. If, for example, a 1,000 acre lake is equally important for both classifications, 500 acres are assigned to the warm water category and 500 acres are assigned to the cold water category. Surface acres of all streams and rivers, including all of the area of the Colorado River adjacent to Arizona, are included in the estimates.

[c] Source: Carr (1973). All estimates are ballpark estimates, but are the best available.

[d] Estimates of huntable range are extremely rough except in the area of the Salt-Verde Watershed, comprising parts of Regions 1, 2, 5 and 7. Estimates for the Salt-Verde Watershed were made by Hammond (1973).

[e] Regions 5 and 7, both abounding Roosevelt Lake, are valued as a single region.

is less than the sum of the values of deer and other big game, since the total huntable area in Region 1 is larger than the deer and other big game hunting areas, and the value of small game, waterfowl and general hunting in Region 1 is relatively small.

Regions 5 and 6 have very large values per square mile for all hunting because of the very high demand for small game hunting in the two Regions, relative to the total huntable range. The weighted average value for the total area of huntable range in the state was $194 per square mile.

Fishing values are computed on the basis of total surface acres of water. By far the highest value per surface acre are the cold waters of Region 1, including the White Mountain streams and small lakes. Values in Regions 2 and 3 are much smaller per surface acre, where total cold water is more plentiful relative to economic demand. No value is shown for Region 4, not because cold water would not have a value in Region 4, but because there is no cold water in southwest Arizona, including the Yuma and Gila Bend areas. Region 5 has some cold water, but Region 1 is adjacent and generally a more preferable cold water fishing area; thus the low value per surface acre. Regions 6 and 7, in southern Arizona have little cold water but are near the population center of Tucson which generates fishing demand. Thus Regions 6 and 7 have high values per surface acre for cold water fishing.

TABLE 22. VALUES OF SURFACE AREA AVAILABLE FOR RURAL OUTDOOR RECREATION IN ARIZONA, BY REGION AND ACTIVITY, 1970.

Region	Average Nondiscriminating Monopolist Value of					
	Deer Hunting	Other Big Game Hunting[a]	All Hunting[b]	Cold Water Fishing	Warm Water Fishing	General Rural Outdoor Recreation[d]
	- - - - - dollars per square mile - - - - -			-dollars per surface acre-		-dollars per square mile-
1	95	94	159	2,423	304	1,045
2	97	42	127	334	68	1,258
3	30	-	30	102	322	250
4	27	-	103	-	229	132
5	17	159	594	184	c	775
6	183	49	479	1,621	364	1,489
7	91	12	159	731	380[c]	166
State	70	46	194	426	283	417

[a] Sections of huntable range are composed of different mixes of big game animals as follows:

Region 1 -- Mostly elk, antelope and turkey. Lion and bear occupy considerable area. Smaller areas of javelina.
Region 2 -- Mostly elk, antelope and turkey. Lion and bear occupy considerable area. Smaller areas of javelina and bighorn sheep.
Region 3 -- Mostly antelope and bighorn sheep. Lion occupy a considerable area. Smaller areas of bear, turkey and elk.
Region 4 -- Mostly javelina and bighorn sheep. Lion are restricted to smaller areas.
Region 5 -- Mostly javelina. Lion occupy a considerable area. Smaller areas of elk, turkey, bear, antelope and bighorn sheep.
Region 6 -- Mostly javelina. Smaller areas of lion, bear, turkey, antelope and bighorn sheep.
Region 7 -- Mostly javelina. Lion occupy a large area. Smaller areas of elk, antelope, bear and turkey.

[b] Include small game, waterfowl and general hunting, as well as deer and other big game. Values depend on mix of hunting values compared to total hunting area.

[c] Regions 5 and 7, both abounding Roosevelt Lake, are valued as a single region.

[d] Computed on the basis of all surface area, not just rural area; therefore, values are underestimated. The major underestimation would be in Regions 5 and 6, which contain Phoenix and Tucson, respectively.

The values for warm water fishing are much more stable across the state. Region 2 includes the Colorado River and thus a relatively large area, but much of this area is inaccessible to fishermen (e.g., that area within the Grand Canyon), and so the average surface acre has relatively little value. Regions 3 and 4 also include the Colorado River, but here the River is quite accessible. Competition for warm water fishing is high and so is the surface acre value. Regions 5 and 7 both surround and abound the major warm water lakes in Arizona, Roosevelt, San Carlos, Canyon, Saguaro and Apache, and are treated as one region. These Lakes are near the major population centers of the state, Phoenix and Tucson, and have the highest value per surface acre even though they also have the greatest number of acres available.

Estimates for the average value of a square mile of area for general rural outdoor recreation (excluding the value for hunting and fishing) must be considered underestimates, especially in Regions 5 and 6. These values were computed as the total value for the Region, divided by the total area of the

Region including urban area. Except in Regions 5 and 6 which include the metropolitan areas of Phoenix and Tucson, respectively, urban area is an extremely small percent of the total. However, none of the estimates consider that much rural land is inaccessible to recreators also. The value of general rural outdoor recreation is a weighted value for both land and water based activities and is computed on the basis of the total of the land and water surface area. The weighted average value per square mile for the state was $417 in 1970.

The authors hasten to reemphasize that all values presented in Table 22 are rough estimates and many conceptual problems could arise in comparing these values to values of the same land and water resources when used for other non-recreational purposes. Still, it is argued that the esitmates give a reasonable idea of approximate money values. As discussed at the beginning of this report, the value of outdoor recreation is not "priceless", but is reflected in the prices that people are willing to pay for the experience. The estimates of Table 22 give reasonable estimates of these magnitudes.

A FEW ROUGH COMPARISONS

The analysis is limited to a brief and rather rough comparison of land resource values when used in cattle ranching and/or in hunting and the value of water resources in fishing versus in irrigated agriculture. These comparisons are for illustrative purposes only. They do not imply that the activities are substitutes or that use for one activity or the other would be an optimum solution, rather they simply show that the value of the resources when used for recreation, a nonpriced product, compares favorably with the use of the resources in traditional market priced activities.

Table 23 shows estimated values per square mile (one square mile equals one section) of land used in cattle ranching, deer hunting, hunting of other big game, and all hunting for six ranching areas in Arizona that are roughly congruent with the Arizona Game and Fish Management Regions.

Figure 8 shows a map of the state defining the six ranching areas. The areas were selected on the basis of similar land characteristics for grazing. The differences in values between areas given for grazing in Table 23 reflect the value of the land resource in cattle production; in the areas where grazing conditions are poorer, returns are lower than in areas which have prime grazing conditions.

The cattle ranching values within a single area were computed in two ways, thus giving a range in value. The marginal value of public lands represents the annual weighted average price of public land grazing permits at the margin as seen by the individual cattle ranch investor, and as revealed by a survey of ranch sales by Martin and Jefferies [1966]. (Reported values were inflated to 1970 conditions using indices from USDA [1971, 1972]). Prices of public lands, classified by public agencies (i.e., State lands, Forest Service land and Bureau of Land Management lands) were obtained from Martin and Jefferies [1966]. Prices were weighted by the percentages of each type of land in the area [Dickerman and Martin, 1967].

The average value of all lands for ranching is the annual equivalent (at 6 percent interest) of the average sale price of all ranches, including deeded land as well as the rights to public land permits, also as developed by Martin and Jefferies [1966] and reported in Dickerman and Martin [1967]. Whole ranches were selling for the average price per section (640 acres), while the marginal price represents the value of an additional section of public lands when added to a typical ranch in the area.

The values for hunting are the total nondiscriminating monopolist values for the Game Regions divided by the estimated number of sections of huntable range as defined in Table 21.

The hunting values do not reflect the value of the land in terms of the capacity of the land to produce game. Rather, the values reflect the magnitude of the demand determinants which in turn affects the degree of hunting participation. It is the distribution of hunters and total participation on the given land resource that ultimately affects the value of the resource. For this reason, the Southern desert near Tucson has the highest value for deer hunting and the Arizona strip in the northwest corner of the state has a lower value. But, the Arizona strip is widely considered superior deer hunting territory.

In a similar fashion, the high values per section for grazing do not really reflect the productivity of the areas for producing cattle, but rather more closely reflect the demand for cattle ranches by individual investors; that is, the demand for participation in ranching activity. (Differences in values between areas partially reflect productivity.) As discussed by Martin and Jefferies [1966], land values created by the demand for ranches by the public far exceeds that value that would reflect the productivity of the land in producing beef for markets. For example, O'Connell [1972] argues that the resource value for producing beef in the Central Mountain Area (Region 5) lies between $63 per section and a high limit of $357 per section. In this same area, Table 23 shows values of $15 per section for deer hunting, $159 per section for hunting other big game, and an average of $594 per section for all hunting activities.

Comparison of the value of water in alternative activities is even a more complicated problem. For example, estimates of the value of water for use in irrigated agriculture as made by Kelso, Martin and Mack [1974] are in terms of an acre-foot (a volume) of consumptive-use at the margin of use in agriculture. The fishing values of Table 23 are in terms of dollars per average surface acre. Still some rough

TABLE 23. COMPARISON OF CATTLE RANCHING, DEER HUNTING AND OTHER BIG GAME HUNTING VALUES FOR A SECTION OF LAND IN SIX DIFFERENT CATTLE PRODUCING AREAS IN ARIZONA, 1970.

Ranching Area[a]	Annual Value of Cattle Ranching[b]		Average Nondiscriminating Monopolist Value of		
	Marginal Value Public Lands	Average Value of All Lands	Deer Hunting	Other Big Game Hunting[c]	All Hunting
	dollars per section				
Western Desert (Region 4)	55	140	27	d	103
Arizona Strip (Region 2)	119	290	97	42	127
Southern Desert (Region 6)	173	352	183	49	479
Central Mountain (Region 5)	153	355	15	159	594
Central Plateau	236	425			
(Region 1)			95	94	159
(Region 2)			97	42	127
Southeastern Desert (Region 7)	210	558	91	12	159

[a] See Figure 8. These ranching areas roughly compare to Arizona Game and Fish Management Regions as listed below.

Arizona Strip is the upper part of Region 2.
Central Plateau is the lower part of Region 2 and the most huntable portion of Region 1.
Central Mountain is mostly Region 5.
Western Desert is in Region 4.
Southern Desert is in Region 6.
Southeastern Desert is in Region 7.
Ranch budgets are not available for the area equivalent to Region 3.

[b] Total sale prices annualized at 6 percent interest.

[c] See footnote a, Table 22 for types of big game involved.

[d] No estimate.

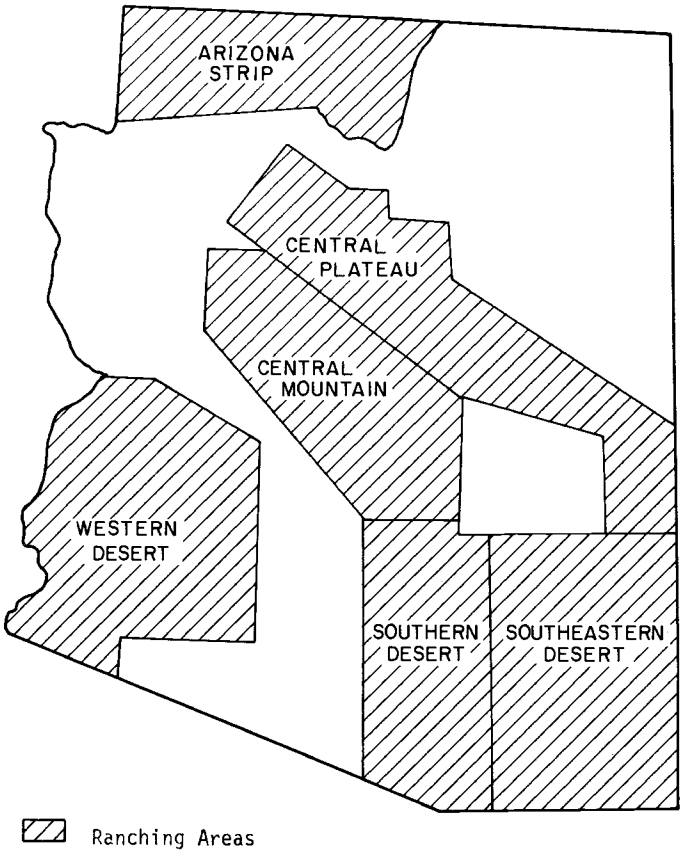

FIGURE 8. RANCHING AREAS IN ARIZONA
Source: Dickerman and Martin (1967)

comparison may be possible. If evaporation from the warm water lakes is about 6 acre-feet per year per surface acre, the average consumptive value of a surface acre of water used only for warm water fishing would be about $300 divided by 6 or $50 per acre foot of consumptive use. The marginal value of the acre foot of water would be lower than the average value. Still, it is clear that the marginal value in fishing must compare favorably with the marginal value in irrigated agriculture.

Solution to these problems of comparing resource values in alternative used must await much further study. It is evident, however, that the demand for hunting, fishing and other rural outdoor recreation activities in Arizona is creating a monetary value which recource use administrators must consider carefully in their plans for the future.

APPENDIX A

DETAILS OF THE ESTIMATION PROCESS

The general method of this research was an adaptation of the Clawson [1959] - Hotelling [1949] approach to estimating the demand for and value of outdoor recreation as described in a general conceptual manner in the text. This appendix focuses on details of the specific estimation process.

RESEARCH DESIGN

Brown and Nawas [1972, 1973] have discussed improved estimates of outdoor recreation demand functions made possible by using observations on individual recreators rather than the traditional approach of averaging individual observations within distance zones as with the original Clawson-Hotelling approach. They showed that with the more efficient use of individual observations, distance traveled (a surrogate variable for travel time) could be included in the statistical demand equation without introducing problems of multicolinearity with variable trip costs. The result of doing so was an improvement in the specification of the demand model, consequently reducing the specification bias of the estimated coefficients for the important variable-cost variable, and resulting in a larger estimate of value for the recreation activity--no matter which value estimate was computed (nondiscriminating monopolist value or consumer surplus value).

In the same paper they commented that while they had reduced the strong negative bias resulting from the complicating factor of travel time and heterogeneity of participants among the various distance zones, there remained the factor of substitute attractions. While the existence of substitute goods would shift a demand curve to the left, an increase in the price of substitute goods will shift the curve to the right. Thus, because the prices of substitute attractions were neglected, a negative bias remained in their estimates, conceptually the best made up until that time, 1972.

This current study of rural outdoor recreation throughout Arizona gave the opportunity to use a large number of individual observations including the mileage variable, as did Brown and Nawas. In addition, by focusing on all types of rural outdoor recreation activities in all regions of the state, rather than simply on a single activity or a single recreation site as many previous studies have done, it was possible to include the prices of substitute attractions in the regression equations. To the authors' knowledge, this is the first time that substitute attractions have been made an integral part of the recreation demand estimation-activity evaluation process.

Given the decision to estimate the demand for all types of rural outdoor recreation in all areas of Arizona, the relevant population to sample for basic data became the total population of the state.

For purposes of this study, the household, as a composite of its elements, was determined to be the rural outdoor recreation consuming unit. The decision to use this definition was based upon the assumption that the household is the decision-making unit. Even though a member of a household can participate in a recreational activity on his own accord, the person still functions within the general decision-making framework of the household. The household is the basic unit "that finances recreation out of a common household budget, and the decision to participate is presumed to have household sanction" [USDI, 1962].

In order to have adequate observations for each statistical demand equation, relatively large numbers of responses from each area of trip origin in the state were desired. Population in Arizona is concentrated in two of the 14 counties. Thus, a random sample of households was selected within each of the 14 counties, the sampling rate per county adjusted to produce approximately 15,000 addresses to which to mail the 14-page questionnaire.

THE QUESTIONNAIRE

The recreation researcher has two alternatives available for accumulating primary data, direct interviews or mailed questionnaires. The average cost of a direct interview necessary to obtain the information required for the overall study, including the gross expenditure information and socioeconomic data reported in Gum et al. [1973], was estimated at $30 to $40 compared to approximately $0.30 for a mailed questionnaire. The large number of responses required for this study and the imposed budget limitations necessitated the use of mailed questionnaires. While decreased accuracy of responses was expected from mailed questionnaires, the total number of respondents that could be reached due to lower average costs was deemed significant.

The questionnaire was divided into three major areas: (a) socioeconomic characteristics, (b) attitudinal characteristics toward hunting and fishing, and (c) three sections relating to participation and costs of participation in hunting, fishing and general rural outdoor recreation activities. Socioeconomic characteristics included information concerning age, sex, marital status, education, income, occupation, length of vacation, number of children, and

number of days off during a normal work week. Explanations as to why a household did not hunt or fish more frequently composed the section on attitudinal characteristics.

The sections on hunting and fishing participation inquired about species, game units hunted or fished, total number of trips and total number of days for each species. A page was included for cost information concerning lodging, food, transportation costs, and other variable expenses for the average trip for each species in each unit. A map showing hunting units was provided by the Arizona Game and Fish Department to assist respondents in recalling areas visited. The general rural outdoor recreation section also inquired about the type of activity, place, total number of days, total number of trips, total number of people and lodging, food, transportation costs and other variable expenses.

RESPONSE AND RESPONSE BIAS

Total usable responses to the 14,713 mailed questionnaires were 2,926 or 19.9 percent of the mailing. Usable response was about 0.6 percent of the total state population of households, ranging from a response of 3.79 percent in a large, sparsely populated county to 0.18 percent in the most metropolitan county. Since response to the mailing was not 100 percent, there was the possibility of response bias.

Respondents were classified into five categories. The categories were those households who purchased one or more hunting license only, those who purchased one or more fishing license only, those who purchased both hunting and fishing licenses but did not have a combination license, and those who did not purchase any licenses at all. By comparing response data with actual licenses sold, it was found that households owning a combination license, the avid sportsmen, responded at a rate of slightly over twice their proportion in the population. Thus, it was assumed that within each county, combination-license-holding households responded in a random fashion, but at a statewide rate of slightly over two times their actual frequency in the population. Their responses were adjusted downward by a factor of 0.4596.

Households who were only fishermen also overresponded slightly. Their bias factor was 0.8547. Households which only hunted underresponded and were thus assigned a bias factor of 1.1920. A weighted-average bias factor of 1.0010 was computed for the households which had both hunting and fishing licenses but did not own a combination license.

Given the response rate for each of the 14 counties and the six statewide bias factors for license holders, it was possible to estimate the number of nonlicense-holding households in each county and thus, to compute a response bias factor for nonsportsmen in each of the 14 counties. Nonsportsmen tended to underrespond, the weighted average response bias factor over all 14 counties was 1.273. The range was 1.141 to 1.892.

The difficulties encountered when one goes to a large mail sample, stratified by counties, are obviously formidable and invite response bias. The authors were sorely tempted to concentrate on a completely random sample of a well-defined population such as hunting and fishing license holders as, for example, did the earlier Davis studies [1962, 1967]. However, if a regression equation for each of eight activities in each of seven regions was to be estimated, if alternative activities were to be included in the regression models, and if the participation, expenditures and socioeconomic characteristics of nonhunters and nonfishermen were to be characterized, the large sample of the total population, stratified by location, was necessary.

Other types of bias due to nonresponse are possible. For example, response rates may have varied with income, education, age, etc. Except for sampling nonrespondents there is no way to adjust for these latter sources of possible bias. However, since among respondents these socioeconomic variables were not highly significant in explaining participation rates, one could conclude that nonresponse associations with these variables would not greatly affect the estimates.

RESULTS OF THE STATISTICAL ANALYSIS

Forty-nine usable demand relationships were derived out of a possible 56 (7 regions times 8 activities). Skips occurred where there were less than 25 observations. The number of observations per equation ranged, for hunting, from 25 to 268; for fishing, from 53 to 615; for general rural outdoor recreation, from 210 to 644. As Brown and Nawas [1972] noted, R^2 values were not high. The ranges and means for the equations selected as the "best" for each region and activity (14 alternative formulations were tried for each demand equation) are as follows: hunting, 29 equations with R^2's of .09 to .82, mean = .33; fishing, 13 equations with R^2's of .07 to .59, mean = .32; general rural outdoor recreation, 7 equations with R^2's of .21 to .40, mean = .32. However, interest was not specifically in obtaining high R^2 values but rather in the reliability of the estimated structural parameters, especially those of the cost variable from which the value of the resource itself is derived under the Clawson-Hotelling [1959, 1949] approach.

In searching for stable, significant, cost coefficients, each demand relationship was estimated with 14 alternative selections of variables as described in Table 24. The dependent variable was always household-trips and the cost variable (variables 1 and 2) was the average cost of the household-trip to that region for that activity, so that, under the second stage of the analysis, added costs could

TABLE 24. VARIABLES INCLUDED IN EACH OF 14 EQUATIONS FIT TO THE DATA ON EACH ACTIVITY IN EACH REGION.

Variables[a]	Selection													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dependent Variable														
Number of trips for activity i to region j in 1970	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Independent Variables														
1. Average variable cost of trips ij	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. (Variable #1)^2	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3. Average round trip mileage ij	X	X	X	X	X	X	X	X	X	X	X	X	X	
4. (Variable #3)^2	X	X	X	X	X	X	X	X	X	X	X	X	X	
5. Total days of outdoor recreation taken in 1970	X	X	X	X	X	X	X		X		X			
6. Total dollars of outdoor recreation variable expense in 1970	X	X	X	X	X	X	X					X		
7. Average variable cost of all other recreation trips taken, excluding trips ij	X		X		X	X			X	X				
8. Total recreation days as a proportion of vacation days	X	X	X	X	X			X						
9. Total recreation variable expense as a proportion of income	X		X	X				X						
10. Average variable cost of all other hunting trips	X	X												
11. Average variable cost of all other fishing trips	X	X												
12. Average variable cost of all other general rural outdoor recreation trips	X	X												
13. Age	X													
14. (Age)^2	X													
15. Vacation	X													
16. (Vacation)^2	X													
17. Education	X													
18. (Education)^2	X													
19. Income	X													
20. (Income)^2	X													

[a] Data relate either to total household (e.g. cost data) or to head of household (e.g. age).

have the practical interpretation of an entry fee per auto into the resource region for the purpose of a particular activity.

When mileage (tr. . time) is excluded from the equation, the cost coefficients are usually larger than when mileage is included as a variable. Under either case, the cost coefficients may be highly significant. Thus, estimates of recreational values per trip derived from grouped data, as they usually have been derived in the past, will usually underestimate the value of the resource since mileage (a surrogate for travel time) cannot be included in the equation without problems of multicolinearity. There will be exceptions, however, depending on the type of activity and the distances involved. For example, small game is usually hunted relatively close to home. For small game hunting in most Arizona regions the coefficient on mileage was not significant and the introduction of this variable into the equation led to higher estimates for the coefficients on cost and thus, to lower estimates of value.

Variable 5, total days of rural outdoor recreation taken in the year, proved quite important in stabilizing the cost coefficients. The coefficient on total days was consistently positive and highly significant, especially for the activities of fishing and general rural outdoor recreation where "t" values were as high as 12. This variable may be viewed as a surrogate for positive "tastes and preferences" for rural outdoor recreation. Inclusion of this variable tends to lower the size of the cost coefficients, though by not nearly as much as the inclusion of mileage, and to raise the estimated value of the resource.

Inclusion of the other variables listed in Table 24 did not have consistent results. One variable might be highly significant for a particular activity in a particular region and not significant elsewhere. Inclusion or exclusion did not materially change the size of the estimated cost coefficients. However, in many cases, Variable 7, the "average variable cost of all other rural outdoor recreation trips taken," was positive and significant.

In Table 25 are listed the regression coefficients for costs and the prices of alternative activities, along with their corresponding "t" values, number of observations involved, and R^2 values for each of three selections for each activity and region where estimation of a statistical demand equation was at all successful. In each case the coefficients are shown for selection 14 where the only independent variables were costs and costs squared. Each case also shows the coefficients of selection 13 where mileage was also included as independent variables. The other selection shown is the "best" equation that includes Variable 7, the cost of alternative outdoor recreation trips. The selection actually used in the evaluation process described below is footnoted. The best equation including Variable 7 was chosen as the equation with the least specification bias if Variables 1 and 2 were statistically significant. If the cost variables of that equation were not significant, selection 13 was the second choice. If the cost variables in the first two selections were not significant, selection 14 was used. In a few cases, selections without statistically significant coefficients were used in order to obtain a value for the region and activity, if the coefficients were of the right sign and the demand equations developed looked reasonable when compared with equations for other regions for the same activity.

EVALUATING THE RESOURCE

In the second half of the Clawson-Hotelling approach to recreation demand, the statistical demand curve (which describes the demand for the total recreation experience) is used to estimate a second demand curve which describes demand for the specific resource or activity itself. For example, the statistical demand curve for the total experience of hunting deer in Region 7, is used to develop a demand curve that describes the alternative quantities of deer hunting trips that would be made to Region 7 at alternative additional costs--for example, at alternative entry fee charges. Of course, access to the region for the activity is now free, and probably always will be, but one wished to know how much households would pay and participate if a were charged.

Mechanically, each regional activity was evaluated as follows:

1. A new demand curve for each individual household was estimated, using the household's observed number of trips as maximum trips at zero cost. The household's decrease in trips was estimated as costs increased, until the household's trips became zero or started increasing. (The estimate would begin increasing in certain cases where the statistical demand curve reached a minimum before touching the cost axis. Since an increase in activity in response to increased cost is not logical, estimated activity was set at zero if the minimum point was reached before estimated activity reached zero.) This procedure utilized the actual number of trips taken by a household and its actual costs per trip to define the household's individual demand curve. Only the two regression coefficients on cost are utilized--thus, the emphasis on eliminating specification bias in developing the statistical demand equation. All independent variables other than the cost variables are ignored since the effects of these shifter variables are included by computing individual demand functions starting with actual trips at zero added cost. That is, for each individual household in the sample,

Actual trips - change in trips = estimated new trips

Change in trips = $-b_1$(added cost) $-2b_2$(original cost x added cost) $-b_2$(added cost)^2

where

b_1 is the coefficient of variable 1 (Table 1)

b_2 is the coefficient of variable 2 (Table 1)

added cost = 1, 2, 3, . . . , 1,000

original cost is the observed value of variable 1 for the individual household

2. Estimates for each individual household were expanded by the relevant response rate and adjusted by the relevant bias factor.

3. Expanded and adjusted individual demand curves were aggregated.

4. The aggregate number of trips and the associated total revenue were printed out at each level of added cost.

5. The nondiscriminating monopolist value (maximum total revenue) and associated added cost were selected by inspection.

6. The consumer surplus value was the cumulative sum of estimated trips since trips were estimated for each additional dollar of added cost until total estimated trips became zero.

Derivation of the computational equation is as follows:

Let T_1 = estimated trips at actual cost

T_2 = estimated trips at added cost

Therefore, Change in trips = $T_1 - T_2$

$$T_1 - T_2 = a + b_1(OC) + b_2(OC)^2 - [a + b_1(OC + AC) + b_2(OC + AC)^2]$$

where OC is original cost
AC is added cost
a is the regression constant
b_1, b_2 are defined as shown above

Thus,

$$T_1 - T_2 = a-a + b_1(OC) - b_1(OC) - b_1(AC) + b_2(OC)^2 - b_2[(OC)^2-2(OC)(AC)-(AC)^2]$$

$$= -b_1(AC) - 2b_2(OC)(AC) - b_2(AC)^2$$

TABLE 25. REGRESSION COEFFICIENTS, "t" VALUES, NUMBER OF OBSERVATIONS AND R^2'S FOR THE STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
Deer Hunting, Region 1					
Selection 5[a]	-.029720 (3.71)	.000665 (3.20)	.021827 (1.27)	152	.43
Selection 13	-.104140 (3.79)	.000669 (2.97)		152	.25
Selection 14	-.132790 (5.64)	.000809 (3.81)		152	.23
Deer Hunting, Region 2					
Selection 6[a]	-.029841 (3.42)	.000034 (2.97)	.011431 (0.70)	268	.24
Selection 13	-.022110 (2.75)	.000027 (2.33)		268	.19
Selection 14	-.038508 (6.31)	.000048 (5.08)		268	.14
Deer Hunting, Region 3					
Selection 6	-.032488 (0.98)	-.000134 (0.36)	.011971 (0.62)	112	.33
Selection 13	-.035066 (1.02)	.000101 (0.26)		112	.22
Selection 14[a]	-.091092 (2.96)	.000641 (1.77)		112	.14
Deer Hunting, Region 4					
Selection 6[a]	-.015683 (0.61)	-.000041 (0.19)	.001468 (0.21)	61	.13
Selection 13	-.006989 (0.28)	-.000054 (0.25)		61	.05
Selection 14	-.006650 (0.28)	-.000051 (0.24)		61	.03
Deer Hunting, Region 5					
Selection 6	-.077799 (1.27)	.000125 (0.14)	-.035651 (1.60)	88	.19
Selection 13	-.091347 (1.49)	.000273 (0.31)		88	.17
Selection 14[a]	-.156070 (3.19)	.001130 (2.51)		88	.13

[a] This selection was used in computing the values for the regional activity.

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
Deer Hunting, Region 6					
Selection 9[a]	-.045295 (2.17)	.000190 (1.40)	.005756 (0.40)	120	.15
Selection 13	-.041460 (1.97)	.000187 (1.35)		120	.07
Selection 14	-.046001 (2.43)	.000212 (1.65)		120	.07
Deer Hunting, Region 7					
Selection 10[a]	-.032970 (3.53)	.000102 (2.28)	.016505 (2.54)	165	.13
Selection 13	-.030462 (3.22)	.000097 (2.13)		165	.10
Selection 14	-.027966 (3.43)	.000087 (2.10)		165	.09
Other Big Game Hunting, Region 1					
Selection 5	-.005526 (0.54)	.000002 (0.20)	.020574 (1.17)	128	.19
Selection 13	-.007835 (0.78)	.000005 (0.68)		128	.15
Selection 14[a]	-.025424 (2.91)	.000019 (2.63)		128	.07
Other Big Game Hunting, Region 2					
Selection 5[a]	-.060328 (1.70)	.000269 (1.37)	.041230 (1.39)	117	.23
Selection 13	-.056087 (1.64)	.000233 (1.16)		117	.10
Selection 14[a]	-.065591 (2.60)	.000279 (1.64)		117	.09
Other Big Game Hunting, Region 5					
Selection 5	-.024663 (1.20)	.000040 (0.36)	-.034713 (1.11)	67	.25
Selection 13	-.014014 (0.82)	-.000004 (0.41)		67	.09
Selection 14[a]	-.021262 (1.27)	.000070 (0.82)		67	.04

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
Other Big Game Hunting, Region 6					
Selection 5	-.027138 (1.01)	.000249 (1.01)	.004758 (0.35)	90	.15
Selection 13	-.028262 (1.14)	.000255 (1.06)		90	.14
Selection 14[a]	-.051700	.000423		90	.09
Other Big Game Hunting, Region 7					
Selection 6[a]	-.092214 (1.27)	.000537 (0.70)	-.013278 (2.01)	64	.23
Selection 14	-.054583 (1.11)	.000382 (0.60)		64	.05
Small Game Hunting, Region 1					
Selection 5[a]	-1.350200 (2.90)	.029603 (2.34)	.249030 (2.03)	70	.12
Selection 13	-.649130 (1.18)	.011498 (0.73)		70	.12
Selection 14	-.733510 (1.78)	.012013 (1.01)		70	.12
Small Game Hunting, Region 2					
Selection 5[a]	-.346760 (3.14)	.003208 (2.92)	.005907 (0.10)	118	.14
Selection 13	-.360150 (3.26)	.003388 (2.78)		118	.13
Selection 14	-.305530 (3.00)	.002393 (2.11)		118	.09
Small Game Hunting, Region 3					
Selection 13[a]	-1.303100 (1.68)	.022460 (1.01)		81	.09
Selection 14	-.906630 (1.41)	.012876 (0.69)		81	.08
Small Game Hunting, Region 4					
Selection 6	-.493270 (1.42)	.003793 (0.99)	.271390 (3.72)	104	.43
Selection 13[a]	-.857040 (2.01)	.007200 (1.52)		104	.09
Selection 14	-.888070 (2.68)	.007536 (1.83)		104	.09

[a] This selection was used in computing the values for the regional activity.

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
Small Game Hunting, Region 5					
Selection 9[a]	-.326510 (2.88)	.002674 (1.85)	.037761 (1.71)	192	.23
Selection 13	-.303790 (2.45)	.002543 (1.59)		192	.06
Selection 14	-.221460 (2.36)	.001741 (1.24)		192	.05
Small Game Hunting, Region 6					
Selection 11[a]	-.362480 (1.96)	.003771 (1.17)		169	.20
Selection 13	-.525920 (2.73)	.006116 (1.82)		169	.09
Selection 14	-.525530 (3.41)	.005901 (2.27)		169	.09
Small Game Hunting, Region 7					
Selection 9[a]	-.606780 (2.08)	.004997 (1.75)	.074278 (0.76)	129	.32
Selection 13	-.360510 (1.19)	.002695 (0.87)		129	.09
Selection 14	-.531080 (2.86)	.004068 (1.70)		129	.08
General Hunting, Region 1					
Selection 9[a]	-.803450 (1.32)	.011851 (1.02)	.146040 (1.11)	35	.28
Selection 13	-.656940 (0.99)	.008320 (0.66)		35	.08
Selection 14	-.382840 (0.76)	.003559 (0.34)		35	.05
General Hunting, Region 2					
Selection 5	-.847640 (1.19)	.023066 (1.01)	.090947 (0.45)	39	.24
Selection 13[a]	-1.039800 (1.70)	.037362 (2.02)		39	.14
Selection 14	-.451530 (0.99)	.015618 (1.11)		39	.04

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
General Hunting, Region 3					
Selection 6[a]	-4.312600 (2.12)	.155230 (1.99)	-.498290 (1.29)	29	.43
Selection 13	-2.490400 (1.37)	.070285 (1.02)		29	.17
Selection 14	-1.433000 (1.51)	.033165 (0.93)		29	.15
General Hunting, Region 5					
Selection 6	-.873450 (0.87)	.011485 (0.51)	1.101900 (2.05)	25	.80
Selection 13[a]	-3.155100 (2.17)	.057678 (1.85)		25	.33
Selection 14	-3.021700 (2.45)	.056941 (1.91)		25	.25
General Hunting, Region 6					
Selection 5[a]	-1.158300 (2.97)	.041093 (2.88)	.098011 (0.87)	43	.26
Selection 13	-.972310 (2.62)	.033801 (2.60)		43	.18
Selection 14	-.839700 (2.57)	.028247 (2.41)		43	.14
General Hunting, Region 7					
Selection 5[a]	-1.143400 (2.83)	.017562 (2.40)	.372070 (1.06)	33	.49
Selection 13	-.900640 (2.03)	.012363 (1.67)		33	.16
Selection 14	-.612810 (1.63)	.008253 (1.23)		33	.11
Waterfowl Hunting, Region 1					
Selection 5[a]	-.528890 (2.23)	.007677 (1.19)	-.062078 (0.59)	31	.82
Selection 13	-.626300 (1.49)	.010950 (0.85)		31	.18
Selection 14	-.509250 (1.62)	.007049 (0.94)		31	.17

[a] This selection was used in computing the values for the regional activity.

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
Waterfowl Hunting, Region 2					
Selection 10[a]	-1.307300 (3.07)	.032468 (2.60)	-.144790 (1.16)	32	.41
Selection 13	-1.235100 (2.92)	.026859 (2.33)		32	.38
Selection 14	-1.001800 (2.46)	.019799 (1.75)		32	.24
Waterfowl Hunting, Region 4					
Selection 6	-.641530 (0.83)	.003052 (0.17)	.378100 (1.28)	35	.65
Selection 13[a]	-2.023300 (2.07)	.032650 (1.38)		35	.27
Selection 14	-2.221100 (2.92)	.036635 (2.27)		35	.26
Waterfowl Hunting, Region 7					
Selection 7[a]	-.514030 (2.11)	.005999 (1.61)		34	.39
Selection 13	-.323230 (1.18)	.003114 (0.75)		34	.11
Selection 14	-.194020 (1.10)	.001904 (0.54)		34	.09
Cold Water Fishing, Region 1					
Selection 1[a]	-.084474 (2.88)	.000264 (2.17)	.091348 (2.45)	615	.32
Selection 13	-.101260 (3.38)	.000324 (2.54)		615	.16
Selection 14	-.184030 (8.20)	.000633 (5.82)		615	.12
Cold Water Fishing, Region 2					
Selection 6[a]	-.259000 (2.07)	.002024 (1.75)	.051678 (1.49)	273	.25
Selection 13	-.214260 (1.72)	.001462 (1.22)		273	.11
Selection 14	-.407750 (4.65)	.002944 (2.92)		273	.09

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
Cold Water Fishing, Region 3					
Selection 9[a]	-.446700 (2.16)	.002811 (2.03)	-.359930 (1.95)	116	.41
Selection 13	-.676200 (3.05)	.003692 (2.40)		116	.24
Selection 14	-.849570 (4.93)	.004768 (3.62)		116	.21
Cold Water Fishing, Region 5					
Selection 13	-.024399 (0.20)	-.000485 (0.29)		58	.17
Selection 14[a]	-.200170 (2.19)	.001633 (1.56)		58	.10
Cold Water Fishing, Region 6					
Selection 4[a]	-.272580 (1.02)	.002890 (0.48)		64	.31
Selection 13	-.244290 (0.83)	.003556 (0.53)		64	.04
Selection 14	-.206340 (0.79)	.002999 (0.49)		64	.02
Cold Water Fishing, Region 7					
Selection 4	-.147030 (1.15)	.000988 (1.05)		91	.54
Selection 13[a]	-.328560 (1.98)	.002176 (1.75)		91	.14
Selection 14	-.436890 (3.24)	.002890 (2.65)		91	.12
Warm Water Fishing, Region 1					
Selection 9	-.011660 (0.25)	-.000047 (0.22)	.017823 (2.98)	115	.26
Selection 14[a]	-.083853 (2.19)	.000297 (1.49)		115	.06
Warm Water Fishing, Region 2					
Selection 13	-.134460 (0.22)	.000082 (0.10)		75	.08
Selection 14[a]	-.685470 (1.94)	.006443 (1.18)		75	.07

[a] This selection was used in computing the values for the regional activity.

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
Warm Water Fishing, Region 3					
Selection 10[a]	-.227410 (1.87)	.000529 (1.67)	.100770 (0.88)	137	.17
Selection 13	-.212540 (1.77)	.000488 (1.56)		137	.17
Selection 14	-.371300 (3.88)	.000826 (2.98)		137	.11
Warm Water Fishing, Region 4					
Selection 5[a]	-.686270 (2.09)	.010298 (1.81)	.050253 (0.97)	133	.55
Selection 13	-1.098600 (2.57)	.014640 (1.94)		133	.14
Selection 14	-1.303800 (3.61)	.017717 (2.60)		133	.13
Warm Water Fishing, Region 5					
Selection 9[a]	-.152440 (2.92)	.000801 (2.30)	.047864 (1.82)	310	.24
Selection 13	-.140900 (2.60)	.000733 (1.98)		310	.08
Selection 14	-.191420 (4.53)	.000998 (3.07)		310	.08
Warm Water Fishing, Region 6					
Selection 6	-.271580 (1.52)	.004328 (1.20)	.078143 (1.70)	53	.29
Selection 13	-.228640 (1.32)	.003635 (1.02)		53	.21
Selection 14[a]	-.355060 (2.45)	.005405 (1.74)		53	.16
Warm Water Fishing, Region 7					
Selection 6[a]	-.431280 (3.71)	.004853 (2.62)	-.158850 (4.08)	224	.59
Selection 13	-.204210 (1.20)	.002509 (0.91)		224	.06
Selection 14	-.334080 (2.66)	.003944 (1.74)		224	.05

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
General Rural Outdoor Recreation, Region 1					
Selection 9[a]	-.016351 (1.71)	.000031 (1.31)	.013951 (1.59)	644	.30
Selection 13	-.014215 (1.46)	.000025 (1.04)		644	.29
Selection 14	-.067280 (8.75)	.000132 (5.78)		644	.24
General Rural Outdoor Recreation, Region 2					
Selection 1	-.012980 (0.86)	-.000012 (0.34)	.038740 (2.23)	767	.34
Selection 13[a]	-.028694 (1.98)	.000055 (1.54)		767	.22
Selection 14	-.107390 (9.32)	.000219 (6.77)		767	.11
General Rural Outdoor Recreation, Region 3					
Selection 1[a]	-.203320 (2.66)	.000799 (2.14)	.063990 (1.49)	277	.40
Selection 13	-.134970 (1.68)	.000528 (1.29)		277	.16
Selection 14	-.323680 (5.25)	.001253 (3.39)		277	.12
General Rural Outdoor Recreation, Region 4					
Selection 1	-.046533 (0.38)	.000145 (0.21)	.088883 (2.19)	210	.37
Selection 13	-.091952 (0.81)	.000256 (0.39)		210	.13
Selection 14[a]	-.303000 (3.71)	.001424 (2.64)		210	.07
General Rural Outdoor Recreation, Region 5					
Selection 6	-.027490 (0.54)	-.000201 (0.38)	-.028899 (1.57)	472	.21
Selection 14[a]	-.100480 (2.38)	.000689 (1.36)		472	.02

[a] This selection was used in computing the values for the regional activity.

TABLE 25. (CONTINUED) STATISTICAL DEMAND EQUATIONS.

Demand Equations	Independent Variable 1	2	7	Number of Observations	R^2
General Rural Outdoor Recreation, Region 6					
Selection 3[a]	-.127300 (1.74)	.001661 (1.74)	.028565 (2.27)	465	.39
Selection 13	-.212040 (2.51)	.001941 (1.68)		465	.06
Selection 14	-.263390 (4.18)	.001913 (2.30)		465	.05
General Rural Outdoor Recreation, Region 7					
Selection 3	-.044647 (1.25)	.000286 (1.06)	.026531 (2.05)	357	.21
Selection 13	-.032982 (0.88)	.000137 (0.51)		357	.10
Selection 14[a]	-.112650 (4.30)	.000574 (2.51)		357	.06

APPENDIX B

RELIABILITY OF THE VALUE ESTIMATES

The estimates of value depend on the reliability of the two regression coefficients, b_1 (on variable cost) and b_2 (on variable cost squared). Table 25 reports the regression coefficients used and their associated "t" values. In general, a "t" value of 2.0 or higher indicates that the regression coefficient is "highly significant", that is, it is unlikely to actually be equal to zero. Most coefficients used in computing values had "t" values of 2.0 or higher. The standard error of each coefficient is not reported, but may be easily computed as

$$\text{standard error (se)} = \frac{\text{coefficient}}{\text{"t" value}}$$

The nondiscriminating monopolist value estimates are computed as the maximum possible size of added cost times visits as estimated from the aggregate demand curve, which in turn, was estimated as the sum of the individual demand curves. The range on the "expected value" of the nondiscriminating monopolist value estimate may be computed as follows:

First, assume the simple case of a linear individual demand curve (the coefficient b_1 is assumed negative and b_2 is assumed equal to zero). Visits are estimated as

$$V = a - b_1 C$$

where

V = estimated visits
a = actual visits at zero added cost
C = added cost
b_1 = the estimated regression coefficient

Thus, nondiscriminating monopolist value (VAL) is computed as

$$VAL = V \cdot C = aC - b_1 C^2$$

To find maximum VAL, set $\frac{\partial VAL}{\partial C} = a - 2b_1 C = 0$

At maximum value

$$C = \frac{a}{2b_1}$$

$$V = \frac{a}{2}$$

$$\text{Max VAL} = \frac{a}{2b_1} \cdot \frac{a}{2} = \frac{a^2}{4b_1}$$

However, b_1 is not estimated without error. Thus,

$\frac{a^2}{4b_1}$ is the "expected value" for the nondiscriminating monopolist value. For a coefficient one standard error higher than estimated $(b_1 + se)$, the value $= \frac{a^2}{4(b_1 + se)}$, a smaller estimate of value. Likewise, for a coefficient one standard error lower than estimated $(b_1 - se)$, the value $= \frac{a^2}{4(b_2 - se)}$, a larger estimate of value.

The ratio of the larger value to the expected value (the value reported herein) is

$$\frac{a^2}{4(b_1 + se)} \Big/ \frac{a^2}{4b_1} = \frac{b_1}{b_1 + se}$$

The ratio of the smaller value to the expected value is

$$\frac{a^2}{4(b_1 - se)} \Big/ \frac{a^2}{4b_1} = \frac{b_1}{b_1 - se}$$

Therefore, if one assumes a plus or minus one standard error variation in b_1, 68 percent of the time the value derived will fall between $\frac{b_1}{b_1 + se}$ and $\frac{b_1}{b_1 - se}$ times the estimated value. Further, it can be shown that the difference between the lower possible value and the estimated value will always be less than the difference between the higher possible value and the estimated value.

If the individual demand curves are linear, the relationships described above will also hold for the aggregate demand curve. Also, the same ratios will hold for the estimates of consumer surplus.

In the more general case, where the individual demand curves are curvilinear, the range and distribution of the values computed from the aggregate demand curve can be established exactly only by numerical methods. The authors are making such estimates but to present them herein would make this report too voluminous.

An intuitive argument about the range in estimated value in the general case leads to the judgment

that the relative range in values would be about the same as in the simple linear case. First, the smallest value would be where the true values of the coefficients were larger than estimated for the linear term and smaller than estimated for the squared term. The largest value would be where the true value of the coefficients were smaller than estimated for the linear term and larger than estimated for the squared term. Thus, the variation on the linear terms is the same as in the simple case, and, since the optimum price is likely to be fairly low and associated with a relatively large number of visits, the nondiscriminating monopolist value is likely to occur on the more linear portion of the demand curve before the squared term takes much effect. Therefore, a reasonable approximation of the possible range in value would be to simply ignore the squared term and estimate the range as in the simple case. For example, for hunting deer in Region 1, if one ignores the coefficient b_2, an assumption of one standard error leads to a range in the estimate for the nondiscriminating monopolist value of from 0.788 to 1.369 times the value reported.

APPENDIX C

VALUES COMPARED TO GROSS EXPENDITURES

As discussed in the Foreword, the gross expenditure method of valuing recreational activity was rejected in this study as being conceptually incorrect. These data are needed, however, as inputs into the statistical demand equations used and have been summarized for statistical purposes in Research Report No. 270 [Gum, et al., 1973].

One reason that the gross expenditure method has been popular, to quote from Clawson and Knetsch [1966], is that "such estimates are likely to yield large figures, which give the impression of a large and profitable tourist-recreation business. Indeed, this is often one of their chief purposes." Past studies of recreation demand, using the traditional Clawson-Hotelling approach with the data averaged within distance zones, have given nondiscriminating monopolist and even consumer surplus values that were smaller than the gross expenditure estimates. Thus, at least in some quarters, the gross expenditure method remained popular in spite of its conceptual inadequacy.

However, Brown and Nawas [1972, 1973] have shown, as discussed in Appendix A, that previous studies using the traditional Clawson-Hotelling approach have significantly underestimated values because of specification bias even though the general method itself was conceptually correct.

In this study the newer individual observation approach was used and specification greatly improved. The results in terms of comparisons of value with the gross expenditure method are shown in Table 26. Nondiscriminating monopolist values compare favorably with gross expenditure values for most activities. The monopolist values are larger in total, tend to be about as large or larger for the more important activities involving considerable travel and other expense, and are significantly smaller only for those minor activities of waterfowl and general hunting where travel and other expense is relatively minor. Consumer surplus values are very much larger than gross expenditures in total and for all activities except waterfowl and general hunting. For these two activities the values are of similar magnitudes.

The comparability of the two sets of estimates are mere coincidence. One method of estimation has an acceptable conceptual base, the other does not. However, the comparisons do show that as the newer methods are adopted, the recreation demand approach may compete successfully on the basis of public relations as well as on its conceptual base.

TABLE 26. NONDISCRIMINATING MONOPOLIST AND CONSUMER SURPLUS VALUES COMPARED TO ACTUAL VARIABLE EXPENDITURES, BY ACTIVITY, ARIZONA, 1970[a]

Activity	Variable Expenditures	Nondiscriminating Monopolist Value	Consumer Surplus Value
All Hunting	$14,404,064	$13,885,814	$34,480,415
Deer	4,512,211	3,717,064	11,246,250
Other Big Game	2,650,100	2,034,966	6,100,267
Small Game	5,355,458	7,752,495	15,651,167
Waterfowl	620,608	127,412	580,882
General	1,265,687	253,877	901,749
All Fishing	$23,422,915	$30,057,922	$64,374,326
Cold Water	14,065,759	11,225,685	30,244,477
Warm Water	9,357,156	18,832,237	34,129,849
General Rural Outdoor Recreation	$36,966,767	$47,639,237	$144,381,917
Grand Total, All Activities	$74,793,746	$91,582,973	$243,236,558

[a] Expenditures and values are those of and for Arizona residents only. Expenditures and values of and for nonresidents are not included.

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